

# CURRICULUM VITAE



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## SEC: 1 SUMMARY OF EXPERIENCE RECORD

### 1.1 PERSONAL:

**NAME:** Dr. Sardar Mohammad Ayub Durrani  
**DATE OF BIRTH:** 22 October 1961  
**NATIONALITY:** Pakistani (Permanent Resident of Canada)  
**CORRESPONDENCE ADDRESS:** KFUPM Box 1831, Dhahran 31261, Saudi Arabia  
**OFFICE PHONE No.:** 966-3-8603869  
**RESIDENCE PHONE No.:** 966-3-8605229  
**E-mail:** [smayub@kfupm.edu.sa](mailto:smayub@kfupm.edu.sa)  
**PRESENT RANK:** (Professor)

### 1.2 ACADEMIC ACCOMPLISHMENTS:

1. S.S.C. First Class 1977 Government Special High School Quetta, Pakistan.  
(Physics, Mathematics, Chemistry etc.)
2. F.Sc. First Class 1979 Government Science Degree College Quetta, Pakistan.  
(Physics, Mathematics, Chemistry etc.)
3. B.Sc. Hon First Class/ First Position 1983 University of Balochistan Quetta, Pakistan.  
(Physics, Mathematics and Statistics)
4. M.Sc. First Class/ First Position 1984 University of Balochistan, Quetta, Pakistan.  
(Physics)
5. Ph.D. 1988 Heriot Watt University Edinburgh (U.K.)  
(RF Excited CO<sub>2</sub> Gas Lasers)

### **1.3 DISTINCTIONS AND HONOURS:**

1. Secured first position in B.Sc. Hons examinations of the University of Balochistan, Quetta, Pakistan.
2. Secured first position in M.Sc. examination of the University of Balochistan, Quetta, Pakistan.
3. Awarded Quaid-i-Azam scholarship (for studies leading to Ph.D.) from Ministry of Education, Islamabad, Pakistan, 1984.
4. Awarded British ORS scholarship, 1986.
5. Member of the laser team " Awarded Prince Mohammad Bin Fahd (Governor of the Eastern Province, Saudi Arabia) Award for Scientific Achievements" 1994.

### **1.4 EMPLOYMENT HISTORY:**

	<b><u>Position</u></b>	<b><u>Period</u></b>	<b><u>Institution</u></b>
1.	Lecturer (Physics)	31-03-1985 to 22-07-1989	University of Balochistan, Quetta, Pakistan.
2.	Assistant Professor (Physics)	23-07-1989 to 28-05-1991	University of Balochistan, Quetta, Pakistan.
3.	Research Scientist III (Assistant Professor)	29-05-1991 to 04-08-1995	RI, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia
4.	Research Scientist II (Associate Professor)	05-08-1995 to 30-01-2001	RI, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia
5.	Research Scientist I	1 <sup>st</sup> Feb.2001 to 31-8-2004	King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia
6.	Associate Professor	01-09-2004 to 24-07-2007	Department of Physics King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia
6.	Professor	24-07-2007 To date	Department of Physics King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia

### **1.5 PROFESSIONAL DEVELOPMENT:**

1. " Second Workshop on Telematics", ICTP, Trieste, Italy. November 1989.
2. " College on High Resolution Spectroscopy", ICTP, Trieste Italy. January 1990.
3. " College on Laser Characterization and Fiber Optics", ICTP, Trieste, Italy February 1990.
4. "College on Laser Characterization and Fiber Optics" ICTP, Trieste, Italy, February 1990.

### **1.6 MEMBERSHIP IN SOCIETIES:**

1. Member, Pakistan Physical Society.
2. Member, Pakistan Institute of Physics.

### **1.7 EXTRA CURRICULUM:**

1. President Rover Scout. The most prestigious award of scouting in Pakistan.
2. Balochistan University Interdepartmental lawn tennis champions 1982.
3. Secured first position in 160 km National Rover Scout hike competition, held in northern Pakistan 1982.
4. Certificates of best performance obtained from Balochistan University (during the period 1980-1984) in football, hockey, badminton and table tennis.

## **SEC: 2 KFUPM-RIPROFESSIONAL SERVICES**

### **2.1 TEACHING**

#### **2.1.1 ACADEMIC TEACHING**

<b>Course Av.</b>	<b>Year</b>	<b>Students Evaluation</b>	<b>Course</b>
GENERAL PHYS 101 Rec.	Spring 1993	8.78/10	7.82/10
GENERAL PHYS 102 Rec.	Spring 1994	8.86/10	7.83/10
GENERAL PHYS 102 Rec.	Spring 1995	9.12/10	7.91/10
GENERAL PHYS 102 Lab.	Fall 1996	9.51/10	7.92/10
GENERAL PHYS 102 LLF	Fall 1997	7.75/10	8.11/10
GENERAL PHYS 102 Lab.	Fall 1998	9.71/10	7.89/10
GENERAL PHYS 102 Lab.	Spring 1998	8.33/10	7.63/10
GENERAL PHYS 102 Lab.	Spring 1999	9.01/10	7.66/10
GENERAL PHYS 102 Lab.	Fall 2000	8.37/10	8.06/10
GENERAL PHYS 102 Lab	Fall 2002	7.42/10	8.02/10
GENERAL PHYS 102 Lab.	Spring 2002	8.49/10	8.16/10
GENERAL PHYS 101 Lab.	Fall 2003	7.88/10	8.12/10
GENERAL PHYS 101 Lab.	Spring 2003	7.53/10	8.06/10

OPTICS-PHYS 211 & Lab.	Fall 2004 (041)	9.08/10	8.95/10
GENERAL PHYS 102 LLF & Recs.	Spring 2005 (042)	8.12/10	8.50/10
GENERAL PHYS 101 Lab.	Fall 2005 (051)	8.21/10	8.12/10
OPTICS-PHYS 211 & Lab.	Fall 2005 (051)	9.59/10	8.17/10
PHYS GRAD. LAB-PHYS 503	Spring 2006 (052)	9.92/10	9.18/10
PREPARATORY PHYS PYP 001	Spring 2006 (052)	8.47/10	8.77/10
GENERAL PHYS 102 LLF & Recs.	Fall 2006 (061)	8.62/10	8.17/10
PREPARATORY PHYS PYP 001	Fall 2006 (061)	8.79/10	
GENERAL PHYS 102 LLF & Recs.	Spring 2007 (062)	8.92/10	
GENERAL PHYS 102 Lab.	Spring 2007 (062)	8.43/10	
GENERAL PHYS 102 LLF & Recs.	Fall 2007 (071)	8.49/10	
GENERAL PHYS 102 Lab.	Fall 2007 (071)	8.61/10	
PREPARATORY PHYS PYP 001	Spring 2008 (072) (3 sections)		
GENERAL PHYS 102 Lab.			

**Note:** In addition to above during my academic career in Balochistan University Pakistan I have also taught several graduate and under graduate courses.

### **2.1.2 SHORT COURSE ON “LASERS AND THEIR APPLICATIONS” (LRS/CAPS 1999)**

I delivered the following lectures;

**Lecture # 1.** What is Inside a Laser?

**Lecture # 2.** Specific Laser Systems.

**Lecture # 3.** Routine and Preventive Maintenance

**Laboratory** Description, Operation and Maintenance of High Power CO<sub>2</sub> Laser System

**Participants’ evaluation of the instructor 4.35/5**

## **2.2 RESEARCH**

### **2.2.1 SUPERVISION OF GRADUATE STUDENTS:**

1. Supervised two M. Phil. thesis (Physics Dept., Balochistan University, Quetta, Pakistan) (1989).
2. Jointly Supervised PHYS 503 student from physics department, KFUPM (1995)
3. Jointly Supervised PHYS 503 students from physics department, KFUPM (040/2004).
4. External Examiner for student “Haya Abdullah Al-Hmiany” MSc Physics, KAU, Jeddah. Thesis title “A Study of Metal Contact to III-Nitrate Film” Oct. 2004.
5. External Examiner for student “*Alaa Yahya Emam Mahmoud*”, MSc Physics, KAU, Jeddah. Thesis title “Parameter Extraction for Surface Barrier Diodes on Wide band Gap Semiconductors” Jan. 2005.
6. External Examiner for student “Ali Zain Hamed Al-Zahrani” M.Sc Physics, KAU, Jeddah. Thesis title “Investigation of Surface Plasmons in Nanostructures” June 2006.
7. Supervising 3 PHYS 503 students from physics department (Spring 2006/52)
8. External Examiner for student “Najat Mohamed Al-Twarqi” M.Sc Physics, KAU, Jeddah. Thesis title “Fabrication and characterization of CdTe thin films for solar cells applications” March 2008.
9. Abul Aziz Al-Aswad: Energy efficient coatings based on WO<sub>3</sub>/Metal multilayers – committee member, department of physics KFUPM (2007/2008).

10. Mahdi Al-Maghrabi: Development of transparent conducting gold-doped ZnO thin films – committee member, department of physics KFUPM (2007/2008).

### **2.2.2 SUPERVISION OF UNDER GRADUATE STUDENTS:**

1. Senior project for EE 411 students from EE department on “Thin film capacitor” was *jointly supervised* (1999).
2. Senior project for EE 411 students from EE department on “Fabrication of thin film electrochromic devices” was *jointly supervised* (2000).
3. Senior project for EE 411 on “Design and fabrication of Anti-reflection films for fiber optic communications” was *jointly supervised* (2001).
4. Senior project for EE 411 on “Design and Fabrication of Anti-Reflection Films for a Fiber Optic Communication System” was *jointly supervised* (2001)
5. Senior project for EE 411 on “Thin Film Temperature Sensors” was *jointly supervised* (2002)
6. Senior project for EE 411 on “Fabrication and Study of Thin Film Capacitor” was *jointly supervised* (2003)
7. Supervised senior project for EE 411 on “Fabrication and Study of Thin Film Thermocouples” (fall 2004/041).
8. Supervised senior project for ME 411 on “Thin Film Gas sensors” (Spring 2005/042 to Fall 2005/051).

### **2.3 SERVICES:**

#### **2.3.1 COMMITTEE WORKS IN RI:**

1. Member, Ad-hoc Receiving Committee for P. O. 792/30015
2. Member, Ad-hoc Receiving Committee for P. O. 792/3928
3. Member, Ad-hoc Receiving Committee for P. O. 792/32012
4. Member, Ad-hoc MOPO Laser Installation Committee 1995
5. Member of ERL Safety Committee 1995-1996-1997
6. Chairman of ERL Committee for “Physical Inventory of Equipment” 1997
7. Member RI Technical Editing Board 1997
8. Chairman of ERL Committee for “Update of Locations and Technical Data Reports” 1997

#### **2.3.2 ADDITIONAL RESPONSIBILITIES:**

9. Liaison officer between the Energy Research Laboratory and the Technical Services of the Research Institute of KFUPM, 1996-1997.
10. Coordinator for Laser Research Section Equipment Maintenance Group, 1996-1997.
11. Coordinator for Laser Research Section Assignment and Activities, 2000 -2001
12. Coordinator for Preparation of Database and Marketing Plan for LRS Short Course May 2000 to 2001.
13. Coordinator for Preparation of Plans for Medical Application of Lasers, 2000-2001.
14. Laser Research Section Safety Officer 2001 to August 2004
15. Fire Warden Building 28 CAPS

### **2.3.3 COMMITTEE WORKS IN PHYSICS:**

1. Member Physics Dept. Research Committee (Fall 2004/041) & (Spring 2005/042)
2. Member Physics Dept. Teaching Lab committee (Fall 2004/041) & (Spring 2005/042)
3. Member Physics Dept. Research Committee (Fall 2005/051-052)
4. Chairman Physics Dept. Teaching Lab committee (Fall 2005/051-052)
5. Member Physics (and Medical Physics) Programs (Fall 2005/051-052)
6. Member Physics Dept. Teaching Lab committee (Fall 2005/061-062)
7. Member Physics (and Medical Physics) Programs (Fall 2005/061-062)
8. Member Physics Dept. teaching committee (2007/2008/071-072)
9. Member Physics Dept. Textbook Review committee (2007/2008/071-072)

## **SEC5: APPLIED AND BASIC R&D ACCOMPLISHMENTS**

### **3.1 LIST OF RESEARCH PROJECT/PROPOSALS**

#### **3.1.1 Projects completed**

Principal Investigator Dr. S. A. I Bari, Co. Investigateurs: Dr. S. M. A. Durrani; Prof. F. Al. Adel; Prof. Uwe Klein; Prof. E. E. Khawaja and Dr. J. W. Shirokoff  
“A joint project on “Formulation of Zeolitic Membrane by Pulsed Laser Deposition phase I”, funded by SABIC (PN 22062). **Sept. 1997-June 1999**

Principal Investigator: Prof. E. E. Khawaja, Co-Investigators: Dr. S. M. A. Durrani and A. M. Al-Shukri  
“Some Energy Saving Applications of Thin Solid films”. An RI internal project (PN 12064). **Sep. 1999-Nov. 2001**

Principal Investigator Dr. S. A. I Bari, Co. Investigators: Dr. S. M. A. Durrani; Prof. Uwe Klein; Prof. E. E. Khawaja and Dr. J. W. Shirokoff.  
“A joint project on “Formulation of Zeolitic Membrane by Pulsed Laser Deposition phase II”, funded by SABIC (PN 22062). **Dec.2001-Nov. 2002**

Principal Investigator: S. M. A. Durrani, Co. Investigators: Prof. E. E. Khawaja and Dr. M. F. Al-Kuhaili  
“Thin Film Gas Sensors”, funded by KFUPM SABIC (SABIC/2001-15).  
**1<sup>st</sup> April 2002 – 31<sup>st</sup> March 2004**

Principal Investigator: Dr. M. F. Al-Kuhaili, Co-Investigators: Dr. S. M. A. Durrani and Prof. E. E. Khawaja  
“Development of a new method for determining the optical constants of thin inhomogeneous films” funded by KFUPM (KFUPM/PH/OPTICAL/286). **1<sup>st</sup> April 2005-31<sup>st</sup> March 2006**



### 3.1.2 Approved Proposal

Principal Investigator; Professor S. M. A. Durrani, Co-Investigators; Dr. M. F. Al-Kuhaili and A. A. Jabbar “Cerium Oxide Thin Film Gas Sensor for Monitoring of Carbon Monoxide” funded by KFUPM (KFUPM/PH/CERIUM/355). **1<sup>st</sup> April 2007- 30<sup>th</sup> Sept. 2008.**

### 3.1.3 Proposal Submitted

Principal Investigator; Dr. M. F. Al-Kuhaili, Co-Investigators; Professor S. M. A. Durrani “Materials fabrication using DC/RF magnetron sputtering” **Submitted to DSR, KFUPM February 2008.**

Principal Investigator; Dr. M. F. Al-Kuhaili, Co-Investigators; Professor S. M. A. Durrani “Synthesis of Sputtered Iron-Doped Zinc Oxide Thin Films as Transparent Conductors for Solar Energy Applications” **Submitted to KACST February 2008.**

***Note:** In 1996, and 1998 we have also submitted projects on “Smart Windows for Buildings and Automobiles” to KACST. The referees reports were excellent. However the KACST did not support the project.*

## 3.2 INTERNATIONAL COLLABORATION

1. **Dr. J. Shirokoff**, Faculty of Engineering and Applied Sciences, Memorial University of Newfoundland, Canada. Dr. Shirokoff, an expert on SEM and XRD was formerly, a researcher at CAL-RI,. We have collaborated with him for SEM and XRD characterization of the thin film sample and as a result, we co authored many research papers with him. Even after his departure from KFUPM, we have been in touch with him for his expert opinions on SEM and XRD results.
2. **Professor D. C. Ingram**, Edwards Accelerator Laboratory, Department of Physics and Astronomy, Ohio University, USA. Prof. Ingram is an expert on the RBS (Rutherford Back Scattering). As the RBS facility at KFUPM has been down for a few years, we sought the help of Prof. Ingram for the RBS analysis of our semiconductor-metal oxide thin films.
3. **Professor S. Akbar**, Center for Industrial Sensors and Measurements, Department of Materials Science and Engineering, Ohio State University, USA. Professor Akbar (materials scientist and visiting Professor of KFUPM) is an expert in the area of thick film gas sensors. Recently we embarked on the area of thin film based gas sensors, our collaboration and exchange of views with Prof. Akbar is all important.
4. **Professor J. Pola**, Laser Chemistry Group, Institute of Chemical Process Fundamental, Academy of Sciences, the Czech Republic, Prague, Czech Republic. Professor Pola is basically a laser chemist. He has visited KFUPM several times and during his visits, we spent a long time together. Our collaboration with Dr. Pola is in the area of thin film prepared by laser ablation. No doubt, we have had a great deal of interaction with him, and also we have co authored a few research papers with Prof. Pola.

### 3.3 PUBLISHED WORK

#### 3.3.1 Papers in Refereed Journals:

- JP1. Vidaud, P., Durrani S.M.A. and Hall D.R.  
“Alpha and Gamma RF Discharges in N<sub>2</sub> at Intermediate Pressures”  
J. Phys. D., V.21 (1988), pp.57-66 (T. Citations: 33)
- JP2. Nasir, S. M. and Durrani S.M.A.  
“Wind Statistics of Quetta Pakistan”  
Energy and Environmental Progress-I, Volume C (1991), Nova Science Publication,  
New York, U. S. A. pp. 17-36.
- JP3. Abu-Jarad, F., Durrani S.M.A and Islam M.A.  
“CO<sub>2</sub> Pulsed Laser Effect on CR-39 Registration Properties”  
Nuclear Instruments and Methods B. V.74 (1993), pp.419-425. (T. Citations: 2)
- JP4. Abu-Jarad, F., Durrani S.M.A and Islam M. A. (T. Citations: 1)  
“Effect of 10.6 μm Pulsed Laser on CR-39”  
Nuclear Track and Radiation Measurements. V.22 nos.1-4 (1993), pp.253-256.
- JP5. Khawaja, E.E., Durrani S.M.A., Hallak A.B., Salim M.A. and Hussain M.S.  
“Density of Thin Vapour Deposited Films of ZnSe”  
J. Phys. D: Appl. Phys. no.27 (1994), pp.1008-1013. (T. Citations: 6)
- JP6. Khawaja, E.E., S.M.A. Durrani and A. B. Hallak (1994).  
“Density of Vapor Deposited Amorphous Ge Films”  
J. Non-Crystalline Solids. v.170, pp.308-311. (T. Citations: 1)
- JP7. Khawaja, E.E., Durrani S.M.A., Al-Adel F.F., Salim M.A. and Hussain M.S.  
“X-ray Photoelectron Spectroscopy and Fourier Transform Infrared Studies of  
Transition Metal Phosphate Glasses”  
J. Material Science, 30 (1994), pp. 225-234. (T. Citations: 14)
- JP8. Durrani S.M.A. and Abu-Jarad F.  
“Heat effect on CR-39 Nuclear Track Detector irradiated by pulsed IR laser”  
NIM (B) 100 (1995), pp. 97-100. (T. Citations: 4)
- JP9. Khawaja, E.E., Durrani S.M.A., Hallak A.B., and Daous M.A.  
“Measurement of Absolute Stopping Cross Sections by Backscattering in Thin  
Dielectric Films”  
NIM (B). 95 (1995), pp. 153-157. (T. Citations: 1)
- JP10. Al-Adel, F. F. and Durrani S.M.A.  
“Single and Multiphoton Absorption of Carbon Dioxide Laser Lines by SO<sub>2</sub> and CO<sub>2</sub>  
Molecules”  
IINuovo Cimento -Vol. 17D, N.10 (1995), pp. 1113-1120. (T. Citations: 2)

- JP11. Durrani S.M.A., Khawaja E.E., Shirokoff J., Daous M.A., Khattak G.D., Salim M.A. and Hussain M.S.  
*"Study of E-Beam Evaporated Sn-Doped In<sub>2</sub>O<sub>3</sub> Films"*  
 Solar Energy Materials and Solar Cells 44(1996), pp. 37-47. (T. Citations: )
- JP12. Durrani S.M.A., Vidaud P. and Hall D. R.  
*"Striation formation time measurements in N<sub>2</sub> alpha RF discharge"*  
 Journal of Plasma Physics, Vol. 58, no. 2(1997), pp. 193-204. (T. Citations: 1)
- JP13. Durrani S.M.A. and Ahmed M.  
*"Infrared Multiphoton Excitation and Dissociation Studies of SO<sub>2</sub>"*  
 IINuovo Cimento, Vol. 19D (1997), pp. 1517-1524. (T. Citations: )
- JP14. Durrani S.M.A., Khawaja E.E., Coban A., and Al-Daous M.A.  
*"Study of Stopping Cross-Section Factors of He Ions in Some Metal Fluoride Films"*  
 AJSE, Vol. 22, No. 2A (1997), pp. 175-181. (T. Citations: )
- JP15. Khawaja E.E., Durrani S.M.A. and Daous M.A.  
*"Optical Properties of Thin Films of WO<sub>3</sub>, MoO<sub>3</sub> and Mixed-Oxides WO<sub>3</sub>/MoO<sub>3</sub>"*  
 Journal of Physics (Condensed Matter), 9 (1997), pp. 9381-9392. (T. Citations: 20)
- JP16. Gondal M. A., Bakhtiari I. A. and Durrani S.M.A. (T. Citations: )  
*"Photoacoustic Spectroscopy of  $\nu_3 - \nu_2$  Combination Band of NO<sub>2</sub>"*  
 Asian Journal of Spectroscopy, Vol. 1, no. 4(1997), pp. 201-209.
- JP17. Gondal M.A., Bakhtiari I. A. and Durrani S.M.A. (T. Citations: 7)  
*"Spectroscopy of Trace Gases Using a Pulsed Optoacoustic Technique"*  
 Journal of Analytical Atomic Spectroscopy, Vol. 13 (1998), pp. 455-458.
- JP18. Khawaja E.E., Durrani S.M.A. and Daous M.A.  
*"Depth Profiling of Inhomogeneous Zirconia Films by Optical and Rutherford backscattering Spectroscopic techniques"*  
 J. Phys. D: Appl. Phys. Vol. 32, no.4 (1999), pp.388-394. (T. Citations: 8)
- JP19. Gondal M. A., Durrani S.M.A., and Khawaja E.E. (T. Citations: )  
*"Laser Pulsed Detector Based on Sn-doped Indium Oxide Films"*  
 European Physical Journal "EPJ" (Applied Physics), Vol. 8 (1999), pp. 37-42.
- JP20. Durrani S.M.A., Vidaud P. and Hall D.R. (T. Citations: )  
*"Stability Region Studies of CO<sub>2</sub> Gas Laser Mixture RF Capacitative Discharge"*  
 European Physical Journal "EPJ" (Applied Physics), Vol. 6, no. 1(1999), pp. 95-100.
- JP21. Khawaja E.E., Durrani S.M.A. and Al-Shukri A.M.  
*"Simple method for determining the Optical Constants of Thin Metal Films..."*  
 Thin Solid Films, Vol. 358 (2000), pp.166-171. (T. Citations: 11)
- JP22. Durrani S.M.A., Khawaja E.E. and Al-Shukri A.M.  
*"Density of thin films of cadmium sulphide by nuclear backscattering"*  
 (Arabian Journal for Science and Engineering) AJSE Vol. 25 (2000), pp. 89-94. (T. Citations: )

- JP23. Durrani S.M.A., Al-Shukri A.M., Iob A. and Khawaja E.E.  
*"The optical constants of zinc sulphide films determined from transmittance measurements"*  
 Thin Solid Films, Vol. 379 (2000), pp.199-202. (T. Citations: 9)
- JP24. Jarallah M.I., Naqvi A.A., AbuJarad F. A., Fazal-ur-Rehman, Durrani S.M.A. and Kidwai S., *"Angular distribution measurements of  ${}^6\text{Li}(p, \alpha){}^3\text{He}$  reaction at 140 keV proton energy using nuclear track detector"*  
 Radiation Measurements Vol. 34, no. 1-6 (2001), pp331-335. (T. Citations: 0)
- JP25. Durrani S.M.A., Khawaja E.E., Salim M.A., Al-Kuhaili M.F., and Al-Shukri A.M.  
*"Effect of preparation conditions on the optical and thermochromic properties of thin films of tungsten oxide"*  
 Solar Energy Materials and Solar Cells, Vol. 71, no. 3(2002), pp 313-325. (T. Citations: 18)
- JP26. Al-Kuhaili M. F., Durrani S.M.A. and Khawaja E.E.  
*"Effects of preparation conditions on the optical and thermocoloration properties of thin films of molybdenum oxide"*  
 Thin Solid Films Vol.408 (2002), pp188-193. (T. Citations: 5)
- JP27. Coban A., Khawaja E.E. and Durrani S.M.A.  
*"Difference between bulk and thin-film densities of various dielectric oxide and fluoride films studied by NRA depth profiling techniques"*  
 NIM-B, V. 194, No.2 (2002), pp 171-176. (T. Citations: 2)
- JP28. Al-Kuhaili M.F., Durrani S.M.A., Khawaja E.E. and Shirokoff J.  
*"Effects of preparation conditions on the optical properties of thin films of tellurium oxide"*  
 J. Phys. D. Applied Physics Vol. 35 (2002), pp 910-915. (T. Citations: 11)
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- JP34. Al-Kuhaili M.F., Khawaja E.E., Ingram D.C., and Durrani S.M.A.  
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- JP38. Durrani S.M.A., Khawaja E.E., Masoudi M., Zdenek Bastel, Jan Subrt, Ana Galikova and J. Pola  
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- JP42. Al-Kuhaili M.F., Durrani S.M.A.  
*“Optical properties of chromium oxide thin films deposited by electron beam evaporation”.*  
 Optical Materials Vol. 29 (2007), pp 709-713

- JP43. Al-Kuhaili M.F., Durrani S.M.A.  
*"Optical properties of erbium oxide thin films deposited by electron beam evaporated"*  
 Thin Solid Films Vol. 515 (2007), pp 2885-2890
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- JP46. Al-Kuhaili M.F. and Durrani S.M.A.  
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 Materials Chemistry and Physics 109 (2008), pp 56-60
- JP 48 Durrani S.M.A. and Al-Kuhaili M.F  
*"Carbon monoxide (CO) gas-sensing properties of electron-beam deposited cerium oxide thin films"*  
 Sensors & Actuators (February 2008) [submitted]
- JP 49 Durrani S.M.A. and Al-Kuhaili M.F  
*"Carbon monoxide (CO) gas-sensing properties of cerium oxide (electron-beam deposited) doped SnO<sub>2</sub> (deposited by Co-thermal evaporation) thin films"*  
 Sensors & Actuators (March 2008) [submitted]

### 3.3.2 Conference Publications

- CP1. Salim, M., Durrani S.M.A., Al-Adel F. and Khawaja E. E.  
*"International Conference on Condensed Matter Physics and Application"*.  
 Bahrain (1993). pp.187-189.
- CP2. Durrani S.M.A. and Al-Adel F.  
*"Second Saudi Symposium on Energy, Utilization and Conservation"*  
 King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia.  
 November 27-30, 1994.
- CP3. Vidaud, P., Durrani S.M.A. and Hall D. R.  
*"Alpha and Gamma RF Discharges in N<sub>2</sub>"*  
 39th Annual Gaseous Electronics Conference, Wisconsin, U.S.A. (1986).

- CP4. Durrani S.M.A., Vidaud P. and Hall D. R.  
*"Discharge Geometry and Frequency Scaling in RF Excited CO<sub>2</sub> Lasers"*  
 8th National Quantum Electronics Conference, St. Andrews, U. K. (1987).
- CP5. Durrani S.M.A., Vidaud P. and Hall D. R.  
*"Optimization of Gain Zone Reduced Fields in RF Excited CO<sub>2</sub> Lasers"*  
 Conference on Lasers and Electrooptics (CLEO), Anaheim, U.S.A. (1988).
- CP6. Durrani S.M.A. et al.,  
*"Stability Region Studies of CO<sub>2</sub> Laser Gas Mixture Capacitative RF Discharges"*  
 Symposium on Frontiers in Physics, Islamabad, Pakistan (1988).
- CP7. Durrani S.M.A. et al.,  
 "14th Nathiagali Summer College on Physics". Islamabad, Pakistan (1989).
- CP8. Khawaja, E.E. and Durrani S.M.A.  
*"Smart Windows (Multilayer Coated Glass) for Buildings and Automobiles"*.  
 4<sup>th</sup> International Symposium on Advanced Materials, September 17-21, (1995)  
 Islamabad, Pakistan.
- CP9. Coban, A., Al-Daous M. A., Khawaja E. E. and Durrani S.M.A.  
*"Thin Film Depth Profiling, Stragglng and Electron Stopping Cross Section Measurements"*.  
 14<sup>th</sup> International Conference on the Application of Accelerators in Research and Industry, Nov., Denton, Texas, USA
- CP10. Khawaja, E.E. and Durrani S.M.A.  
*"Determination of the Refractive Index of an Inhomogeneous Thin Film"*  
 Saudi-French Workshop on "Recent Developments in Materials and Modeling".  
 (Nov. 11-12 (1997), KFUPM-Dhahran, Saudi Arabia).
- CP 11. Khawaja, E.E. and Durrani S.M.A.  
*"Energy Efficient Windows for Buildings and Automobiles"*  
 Saudi-French Workshop on "Recent Developments in Materials and Modeling".  
 (Nov. 11-12 (1997), KFUPM-Dhahran, Saudi Arabia).
- CP12. Gondal, M. A., Durrani S.M.A. and Bakhtiari I. A.  
*"Sensitive Photoacoustic Detection of NO<sub>2</sub> at 10.6 μm.*  
 Saudi-French Workshop on "Recent Developments in Materials and Modeling".  
 (Nov. 11-12 (1997), KFUPM-Dhahran, Saudi Arabia).
- CP13. Gondal, M. A., Khawaja, E.E. and Durrani S.M.A.  
*"Fast Rise Time Thin Oxide film Laser Detector"*  
 13<sup>th</sup> Australian AIP Congress, (September 21-27 (1998)., Freemantle, Western Australia).

- CP14. Jarallah M.I., Naqvi A.A., AbuJarad F. A., Durrani S.M.A., Fazal-ur-Rehman, Kidwai S. and Nassar R. “*Angular distribution measurements of  ${}^6\text{Li} (p, \alpha) {}^3\text{He}$  reaction at 140 keV proton energy using nuclear track detector*”  
20<sup>th</sup> International Conference on Nuclear Tracks in Solids  
(August 28-September 01 (2000), Slovenia)
- CP15. Durrani S.M.A., Khawaja E. E., Al-Kuhaili M. F. and Al-Shukri A. M.  
“*Thin film sensors*”  
First Saudi Conference: New Trends for College of Sciences in Saudi Arabia  
“Conference on Creative Education and Industrial Research”.  
April, KFUPM, Dhahran, Saudi Arabia, Volume-Physics (141-148) (2001).
- CP16. Khawaja E. E., Durrani S.M.A., Al-Kuhaili M. F. and Al-Shukri A. M.  
“*Optically switch able thin solid films*”.  
First Saudi Conference: New Trends for College of Sciences in Saudi Arabia  
“Conference on Creative Education and Industrial Research”.  
April, KFUPM, Dhahran, Saudi Arabia, Volume-Physics (149-156) (2001).
- CP17. Al-Shukri A. M., Durrani S.M.A., Al-Kuhaili M. F. and Khawaja E. E.  
“*Some energy saving applications of thin solid films*”  
First Saudi Conference: New Trends for College of Sciences in Saudi Arabia  
“Conference on Creative Education and Industrial Research”.  
April, KFUPM, Dhahran, Saudi Arabia, Volume-Physics (157-166) (2001).
- CP18. Al-Shukri A. M., Durrani S.M.A., Khawaja E. E. and Al-Kuhaili M. F. (2004)  
“*Thin Film coated energy-efficient glass windows for warm climates*”  
The 8<sup>th</sup> Arab Solar and Regional World Renewable Energy Congress. Conference and  
Exhibition March 8-10 March, Kingdom of Bahrain
- CP19. Durrani S.M.A, Khawaja E. E. and Al-Kuhaili M. F. (2004)  
“*Development of SnO<sub>2</sub> thin film gas sensor for monitoring of CO*”  
Second Saudi Science Conference,  
(Oral presentation: paper # phys-389). March 15-17 2004, Jeddah.
- CP20. Al-Shukri A. M., Durrani S.M.A.  
“*Effect of Biasing Voltages and electrode metals on the sensitivity of electron beam evaporated HfO<sub>2</sub> thin film CO sensor*”  
Third Saudi Science Conference  
Riyadh, Saudi Arabia, 10-13 March 2007

### **3.4 EDITORIAL WORK:**

1. Reviewed Articles for the Arabian Journal of Science and Engineering (1993-1994)
2. Reviewed Articles (NIM-B) (1994-95)
3. Reviewed Articles for the Asian Journal of Spectroscopy (1998)
4. Reviewed Proposal for KACST, March (2005)
5. Reviewed Proposal for King Abdul Aziz University, Jeddah, January (2006)
6. Reviewed Article for Materials Science and Engineering B March (2006)
7. Reviewed Articles for IEEE Journal (Sensors) (2007)



8. Reviewed Article for Materials Science and Engineering B (2007)

### **3.5 SEMINARS:**

1. "Excitation of CO<sub>2</sub> Laser by RF Discharge Excitation" (1992)  
CAPS-RI, KFUPM
2. "Smart Windows for Buildings and Automobiles" (1999)  
LRS, CAPS-RI, KFUPM
3. "Thin Film Gas Sensors" CAPS-RI, KFUPM, (2000).
4. "Some applications of thin solid films" Physics Dept. KFUPM, March (2003)
5. "Monitoring of CO in Flue Gas" Research Institute, KFUPM, March (2004)
6. "Applications of Thin Solid Films" Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, Pakistan August (2005)
7. "Advancements in Thin Film Gas Sensors" Physics Department, Baluchistan University, Quetta-Pakistan, July (2006)
8. "Application of thin films in monitoring of hazardous gases" Baluchistan University of Information Technology, Quetta-Pakistan, June (2006)
9. "Development of Cerium Oxide Thin Film Gas Sensor for Monitoring Carbon Monoxide" Physics Department, KFUPM, 21<sup>st</sup> Jan. (2007)

## **SEC: 4 RESEARCH LEADERSHIP:**

### **4.1 RESEARCH PROJECTS:**

I joined KFUPM in May 1991 (initially the research institute and later transferred as a policy matter to physics department in September 2004). Since then as a founding member I have been actively involved in developing the IR laser and thin film laboratories and on the same time started basic and applied research. These include:

(i) **Characterization of thin films prepared by e-beam and resistive heating.** In this regard thin films of different materials such as Ge, ZnSe, WO<sub>3</sub>, ZnS, V<sub>2</sub>O<sub>5</sub>, MoO<sub>3</sub>, TiO<sub>2</sub>, MgF<sub>2</sub>, LaF<sub>3</sub>, NdF<sub>3</sub>, ThF<sub>4</sub> and Sn-doped In<sub>2</sub>O<sub>3</sub> HfO<sub>2</sub>, CeO<sub>2</sub>, Er<sub>2</sub>O<sub>3</sub>, Ga<sub>2</sub>O<sub>3</sub> etc. have been prepared. The XPS, FTIR, RBS, SEM and X-ray diffraction and more recently AFM studies of these films were performed. In this regard several projects have been completed and published more than 47 papers.

(ii) **Some Energy Saving Applications of Thin Solid Films**

The main objective of this project was to develop laboratory-scale versions of (a) multilayer thin film coated energy-efficient glass windows for applications in warm climates and (b) devices using thin solid films for passive cooling of their surfaces to temperatures well below ambient levels, using no external energy source.

**A) Energy-Efficient Glass window (Heat Mirror)**

Multilayer of various metal and metal oxides such ZnS/Ag/ZnS/glass, WO<sub>3</sub>/Ag/WO<sub>3</sub>/glass and TiO<sub>2</sub>/Ag/TiO<sub>2</sub> were characterized and developed successfully highly energy-efficient heat mirrors on the lab scale. Several papers have also been published in reputable journals of high impact factor.

## **B) Passive-cooling surfaces**

Multilayer thin film systems for passive-cooling of surfaces were prepared and tested successfully. On testing these systems, it was found that temperatures as far as 12 °C below the ambient could be achieved.

**(iii) *Environmental studies:*** In order to utilize the knowledge and achievements which I gained from my basic research in the thin film characterization, I have designed a new experimental setup for thin film gas sensors. The whole setup was fabricated in the workshop of physics department locally. After completion of the setup a project on “thin film CO gas sensor” has been completed by developing SnO<sub>2</sub> CO sensor successfully and published several papers. More recently another project on CeO<sub>2</sub> CO gas sensor has been approved for KFUPM internal funding. In this regards pure CeO<sub>2</sub> thin film sensor prepared by e-beam has been developed for the first time. Two papers have already been submitted, while further advancements are in progress.

**(iv) *Study of laser ablated thin films:*** Thin films of phosphate glasses containing oxides of Fe, Co, Ni, Cu, and Zn were prepared by CO<sub>2</sub> laser ablation on different substrates such as quartz and KBr. The XPS and FTIR studies of these films were also performed. Furthermore we have completed two projects for SABIC entitled “Formulation of Zeolitic Membrane by Pulsed Laser Deposition phase I and II”. As a part of my continuous effort I establish collaboration with several internationally renowned scientists. More recently working with scientists from Academy of Sciences of Czech Republic I studied desulphurization of polymers containing sulfur by CO<sub>2</sub> laser ablation and published two papers. In addition new proposal on “development of thin film thermal switches prepared by laser ablation” has been finalized and will be submitted in due time.

**(v) *Laser spectroscopy:*** After developing IR laser laboratory research is being conducted in the field of molecular spectroscopy, this include the study of single and multiphoton absorption of CO<sub>2</sub> laser lines by SO<sub>2</sub> and CO<sub>2</sub> molecules.

It is worth mentioning that in recognition of my work; more than 153 authors have cited it and others contacted me requesting copies of my published work.

## **4.2 LABORATORY DEVELOPMENT RESPONSIBILITIES:**

I am in charge of IR and nuclear target preparation laboratories; this includes the Operation and Maintenance of the following systems:

1. The high power CO<sub>2</sub> laser system Lumonics model TEA-820 with two TE-820HP amplifiers and related equipment.
2. Laser ablated thin film coating unit and related equipment.
3. Thin film gas sensor experimental setup
4. Operation and maintenance of the thin film coating unit Leybold AG model UNIVEX 450 in the nuclear target preparation laboratory.
5. In addition of the above I am also involved in operation and maintenance of the thin film coating unit Leybold AG model L560 in the thin film laboratory.

### **4.3 DESIGN OF MAJOR EQUIPMENT:**

In addition to the experiments, maintenance and operations of above mentioned systems; I have been involved in designing major components as per the requirement:

Heat exchangers for high temperature gas processors (part of the high power CO<sub>2</sub> Laser system): The supplied aluminum heat exchangers manufactured by Laser Company had water flow of @ 2.5 lit/minute, while the one designed has almost 10 lit/minute that increased the cooling and hence laser efficiency. Most important feature of this design is: instead of aluminum I used copper to overcome the problem of copper ions (present in the ERL closed loop deionized water systems) and its chemical interaction with aluminum heat exchanger, which ultimately blocked the heat exchangers after few months. In case of copper heat exchangers there would be no interaction and hence blocking. The newly designed heat exchanger was fabricated at the CAPS workshop. It is being used since 1992. Based on our achievements the manufacturer of the laser company has also started manufacturing copper heat exchangers for similar closed water systems.

Special cooling system for high power CO<sub>2</sub> laser system: The  $\Delta p$  (i.e. difference between the chilled water supply and return lines) of CAPS building is @ 15-20 psi, while for CO<sub>2</sub> laser system the required  $\Delta p$  is 40-50 psi. In this regard using the existing entirely new cooling system was designed to over come this problem by using the existing chilled water lines.

Additional Evaporation Source for Thin Film Coating Unit: For multilayer coatings of thin films, I have jointly designed and installed an additional evaporation source in the coating unit. The additional source made it possible to coat various layers of different materials simultaneously without breaking the vacuum and hence retaining the quality of the films.

Rotating Substrate Holder for Laser Ablation Unit: For laser ablated thin film coating unit a new substrate holder has been designed. In this case substrate holder is mounted on a very small dc electrical motor, whose speed is controlled with specially designed circuit. The speed of the motor controls the uniformity of the deposition. Originally the substrate was on a stationary mount and the deposition was not uniform.

Experimental Setup for Thin film Gas Sensor: A new experimental setup for thin gas sensors was developed. In this regards for "Thin Film Gas Sensors" gas-handling system and sophisticated measurements chamber is designed and fabricated in the workshop of ERC, where measurements for various experimental conditions will be made. Moreover recently the up gradation and automation of the gas sensing setup (including data acquisition system) is completed. This will enable us to control and observe the experiment in progress remotely through the network.

In addition to the above, small experimental setups as per requirement has also been designed.

## CITATIONS:

### A: Citations of Papers Published From 2002 to Date (Excluded Self-Citations)

**Source Paper: JP25. Durrani S.M.A., Khawaja E.E., Salim M.A., Al-Kuhaili M.F., and Al-Shukri A.M.**

*“Effect of preparation conditions on the optical and thermochromic properties of thin films of tungsten oxide”.*

**Solar Energy Materials and Solar Cells, Vol. 71,no.3 (2002), pp 313-325**

#### Citations:

1. Zhou, L., Ren, Q., Zhou, X., Tang, J., Chen, Z., Yu, C.  
Comprehensive understanding on the formation of highly ordered mesoporous tungsten oxides by X-ray diffraction and Raman spectroscopy  
Microporous and Mesoporous Materials 109 (1-3), pp. 248-257 (2008)
2. Montanari, B., Ribeiro, S.J.L., Messaddeq, Y., Li, M.S., Poirier, G.  
Thin films prepared from tungstate glass matrix  
Applied Surface Science 254 (7), pp. 2085-2089 (2008)
3. He, Y., Zhao, Y  
Near-infrared laser-induced photothermal coloration in WO<sub>3</sub>·H<sub>2</sub>O nanoflakes  
Journal of Physical Chemistry C 112 (1), pp. 61-68 (2008)
4. Fernandes, V.C., Santos, M.C., Bulhões, L.O.S.  
“Nanogravimetric studies of tungsten oxide thin films obtained by the polymeric precursor method”  
Thin Solid Films 515 (18), pp. 7155-7161 (2007)
5. Joraid, A.A., Alamri, S.N.  
“Effect of annealing on structural and optical properties of WO<sub>3</sub> thin films prepared by electron-beam coating”  
Physica B: Condensed Matter 391 (2), pp. 199-205 (2007)
6. Lu, D.Y., Chen, J., Chen, H.J., Gong, L., Deng, S.Z., Xu, N.S., Liu, Y.L.  
“Raman study of thermochromic phase transition in tungsten trioxide nanowires”  
Applied Physics Letters 90 (4), art. no. 041919 (2007)
7. Niklasson, G.A., Granqvist, C.G.  
“Electrochromics for smart windows: Thin films of tungsten oxide and nickel oxide, and devices based on these”  
Journal of Materials Chemistry 17 (2), pp. 127-156 (2007)
8. Deepa M, Singh P, Sharma SN, et al.  
“Effect of humidity on structure and electrochromic properties of sol-gel-derived tungsten oxide films”  
*Solar Energy Materials and Solar Cells* 90 (16): 2665-2682 OCT 16 (2006)

9. Deepa M, Srivastava AK, Kar M, et al.  
“A case study of optical properties and structure of sol-gel derived nanocrystalline electrochromic WO<sub>3</sub> films”  
*J. Phys. D: Appl. Phys* 39 (9): 1885-1893 MAY 7 (2006)
10. Deepa M, Joshi AG, Srivastava AK, et al.  
“Electrochromic nanostructured tungsten oxide films by sol-gel: Structure and intercalation properties”  
*Journal of Electrochemical Society* 153 (5): C365-C376 (2006)
11. Deepa M, Saxena TK, Singh DP, et al.  
“Spin coated versus dip coated electrochromic tungsten oxide films: Structure, morphology, optical and electrochemical properties”  
*Electrochimica Acta* 51 (10): 1974-1989 FEB 1 (2006)
12. Teoh LG, Shieh J, Lai WH, et al.  
“Structure and optical properties of mesoporous tungsten oxide”  
*Journal of Alloys and Compounds* 396 (1-2): 251-254 JUN 21 (2005)
13. Deepa M, Sharma R, Basu A, et al.  
“Effect of oxalic acid dihydrate on optical and electrochemical properties of sol-gel derived amorphous electrochromic WO<sub>3</sub> films”  
*Electrochimica Acta* 50 (16-17): 3545-3555 MAY 30 (2005)
14. Soto G, De la Cruz W, Diaz JA, et al.  
“Characterization of tungsten oxide films produced by reactive pulsed laser deposition”  
*Applied Surface Science* 218 (1-4): 281-289 SEP 30 (2003)
15. Hussain Z  
“Dopant-dependent reflectivity and refractive index of microcrystalline H<sub>x</sub>WO<sub>3</sub> and Li<sub>x</sub>WO<sub>3</sub> bronze thin films”  
*Applied Optics* 41 (31): 6708-6724 NOV 1 (2002)
16. Lackner, J.M., Waldhauser, W.  
“Vacuum coating - Some like it cold - Part 2- Ambient temperature coating concepts for wide-ranging applications | [Vakuumbeschichtung - Some like it cold - Teil 2: Raumtemperatur- Beschichtungskonzepte für vielseitige Anwendungen]”  
*Galvanotechnik* 96 (9), pp. 2208-2216 (2005)

**Source Paper: JP26 Al-Kuhaili M. F., Durrani S.M.A. and Khawaja E.E.**

***“Effects of preparation conditions on the optical and thermocoloration properties of thin films of molybdenum oxide”  
Thin Solid Films Vol.408 (2002), pp188-193***

**Citations:**

1. Niklasson, G.A., Granqvist, C.G.  
“Electrochromics for smart windows: Thin films of tungsten oxide and nickel oxide, and devices based on these”  
*Journal of Materials Chemistry* 17 (2), pp. 127-156 (2007)

2. Mohamed SH, Kappertz O, Ngaruiya JM, et al.  
“Correlation between structure, stress and optical properties in direct current sputtered molybdenum oxide films”  
*Thin Solid Films* 429 (1-2): 135-143 APR 1 (2003)
3. McEvoy TM, Stevenson KJ, Hupp JT, et al.  
“Electrochemical preparation of molybdenum trioxide thin films: Effect of sintering on electrochromic and electroinsertion properties”  
*Langmuir* 19 (10): 4316-4326 MAY 13 (2003)
4. Pereira, A.C., Ferreira, T.L., Kosminsky, L., Matos, R.C., Bertotti, M., Tabacniks, M.H., Kiyohara, P.K., Fantini, M.C.A.  
Characterization of electrochemically co-deposited metal-molybdenum oxide films  
*Chemistry of Materials* 16 (13), pp. 2662-2668 (2004)

**Source Paper: JP27. Coban A., Khawaja E.E. and Durrani S.M.A.**

*“Difference between bulk and thin-film densities of various dielectric oxide and fluoride films studied by NRA depth profiling techniques”*  
**NIM-B, V. 194, No.2 (2002), pp 171-176.**

**Citations:**

1. Pilvi, T., Hatanpää, T., Puukilainen, E., Arstila, K., Bischoff, M., Kaiser, U., Kaiser, N., (...), Ritala, M.  
“Study of a novel ALD process for depositing MgF<sub>2</sub> thin films”  
*Journal of Materials Chemistry* 17 (48), pp. 5077-5083 (2007)

**Source Paper: JP28. Al-Kuhaili M.F., Durrani S.M.A. Khawaja E.E. and Shirokoff J.**

*“Effects of preparation conditions on the optical properties of thin films of tellurium oxide”*  
**J. Phys. D. Applied Physics Vol. 35(2002), pp 910-915**

**Citations:**

1. Su, F.  
“Energy transfer and sensitization blue-upconversion in Tm<sup>3+</sup>/Yb<sup>3+</sup> co-doped tellurite glasses”  
*Journal of Modern Optics* 54 (18), pp. 2819-2826 (2007)
2. Dewan, N., Sreenivas, K., Gupta, V.  
*Influence of  $\gamma$  -radiation doses on the properties of TeO<sub>x</sub>: (x=2-3) thin film*  
*Journal of Applied Physics* 102 (4), art. no. 044906 (2007)
3. Teterin, Yu.A., Nefedov, V.I., Churbanov, M.F., Teterin, A.Yu., Maslakov, K.I., Zorin, E.V.  
*“X-ray photoelectron study of Te-W-O and Te-W-La-O glasses”*  
*Inorganic Materials* 43 (8), pp. 888-896 (2007)
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