The heat effect on CR-39 nuclear track detectors irradiated by a pulsed IR laser

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Abstract

The heat conduction effect in CR-39 nuclear track detectors, exposed to a pulsed infrared laser of wavelength 10.6 μm was studied. The deposited energy was 120 mJ per pulse, with a total energy of 100 J as a function of laser repetition rate from 1–10 Hz. Each set of ten CR-39 detectors was irradiated on a different substrate holder of aluminum, graphite and air. In the case of the aluminum substrate holder the bulk etch rate (V_b) and track etch rate (V_t) did not change, however the graphite showed some changes, while changes were significant in air. In the case of air and graphite at 10 Hz a simultaneous softening and hardening on the same detectors was observed. The effect of laser wavelength variation on CR-39, between laser wavelengths of 9 to 11 μm for the aluminum substrate holder and various deposited laser energies up to 120 J, was also studied. It was found that wavelength variation has no effect on CR-39 parameters. Moreover, a set of seven CR-39 detectors were heated at different temperatures ranging from 22°C to 250°C for 90 min. The results indicate that the bulk etch rate (V_b) increased significantly at temperatures between 125 to 200°C. However, for higher temperatures the detector could not be sustained. The uv–visible absorption spectrum of the laser irradiated and thermally heated samples showed red shifts.