Microscopic characterization of conical structures on polycarbonate surface induced by ArF laser

[1] H.Ehsani [2]S.Sheikh Kazemi

[1] Department of physics, Islamic Azad University, Nour branch, Mazandaran, Iran

[2,] plasma research center, Islamic Azad university science and research branch, Tehran, Iran

A_ehsani_phys@yahoo.com

Summery

Laser ablation has proved to be an effective tool for micromachining of polymers because of their unique physical and chemical properties, and high quality of resulting patterns. Among the many aspects of laser ablation, we are interested here in conical structures induced by excimer laser radiation on polycarbonate surfaces and changes of geometrical structure of these micro cones as a function of laser fluence and its pulse number

Experimental set up

In this letter we report the development of conical structures on polycarbonate (PC) using a 193 nm ArF laser with nanosecond pulswidth at various energy densities and pulse number. We used 1.5 × 1.5 cm^2, with1 mm-thick PC samples, manufactured bye Byer with trade name of makrolon. The morphology of the samples was investigated by scanning electron microscopy (SEM). There are two possibilities for the origin of these micro cones: impurities and carbon enrichments [1, 2]. According to EDX analysis, it has been concluded that their origin is associated with carbon enrichment spots on our polycarbonate surface.

Discussion

The number density of the conical structures is affected by the irradiation parameters (F, N) .As it is shown in fig 1(a-b) by increasing the incident fluence the number density of the cones is decreasing. Considering thisFigure it has been obviously observed that the apex angle and base diameter of these micro cones have strong dependency on laser fluence. By using Imagj software these geometrical structure of micro cones can be calculated. At the laser fluence 24 mJ/cm^2 apex angle and base diameter were 86.82° and 1.66 micrometer and for 62.5 mJ/cm2 they were 63.28° and 3.34 micrometer respectively .However on the contrary of fluence by increasing the pulse number the micro cones formation increased. As a result, at lowest pulse number (N=1) no micro cones have been observed in all feluences and when N approaching to 100, micro cones have been gradually appeared

Conclusion

It has been shown that UV irradiation of PC can make some micro pattern (micro cones) around carbon enriched spots of PC surface. The ablation threshold of these spots must be higher than its surroundings .As it has been expected that by increasing the laser fluence, this structure tends to be disappeared

References:

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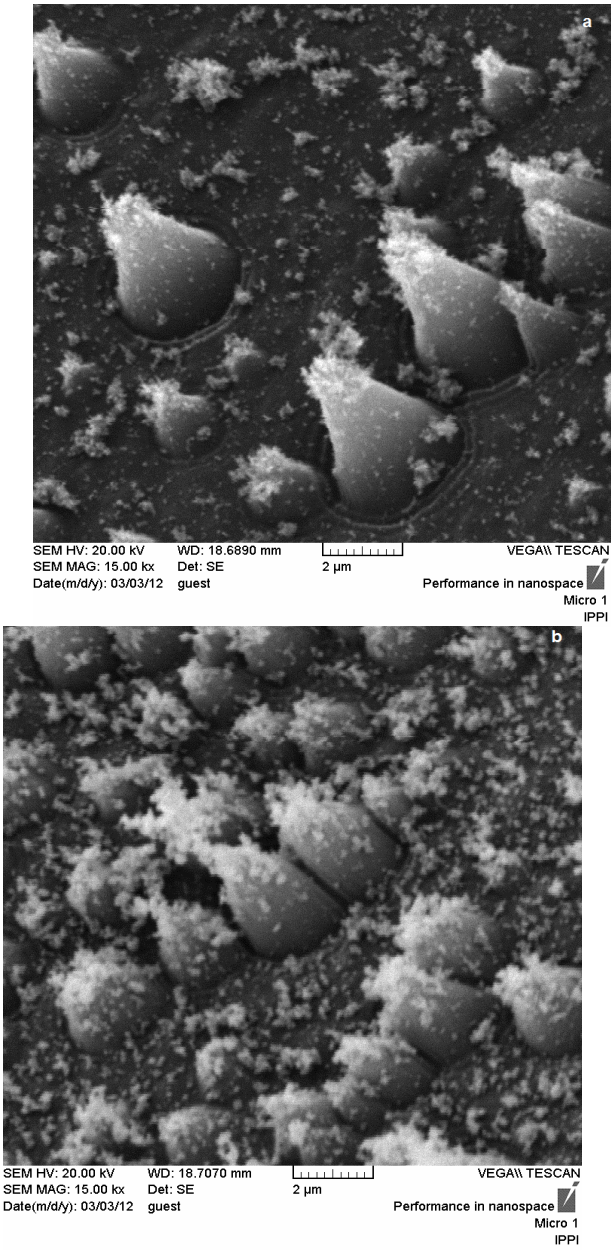

Fig1. Conical structure on PC, pulse number (N) =100, a) F = 62.5 mJ/cm^2, b) F = 50 mJ/cm^2