14:00-, Mon 19th-June-2023
KPSI, Kyoto, JAPAN
The 98th KPSI Seminar, QST

Near-infrared femtosecond laser writing of controlled surface wettability

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Abstract

Laser is a widely accepted tool for surface modification of polymer surfaces for tailoring wettability behaviour. It is well established that irradiation of UV laser operating over a polymer surface such as polymethyl methacrylate (PMMA) [1], polyimide [2] can be used to obtain a more hydrophilic nature surface. It is possible as the photon energy of UV laser energy has sufficient power to directly break the chemical bond of the polymer molecule, thereby releasing more polar components on the surface. However, a variety of research describes regulated wettability modification using femtosecond (fs) lasers in the near-infrared region [3][4]. It is claimed that the surface can attain both hydrophobic and hydrophilic surfaces by shining a fs laser. In contrast, De Marco *et al.* [5] asserted that regardless of laser energy, fs laser operation at infrared wavelength creates exclusively non-wetting surfaces, i.e., hydrophobic nature. Besides modifying the surface chemistry, changing the surface morphology can also modify the surface wettability [3]. Various works have been reported on the investigation of different laser types for laser-induced surface wettability. However, scant work has been reported on the application of a fs laser working at a near-infrared wavelength for attaining a hydrophobic and hydrophilic surface on PMMA without modifying the surface chemistry of PMMA.

The discussion in the presentation will centre on the use of a fs laser operating at a near-infrared wavelength to induce various wettability behaviours in PMMA. The determination of the ablation threshold of PMMA ablation and optimisation of input process parameters will be the topics of the talk. A thorough analysis of the chemical and surface morphological changes caused by fs lasers that relate to surface wettability will also be covered.

References:
1. Microfluid. Nanofluidics. **5** (2008) 139–143.
2. J.Mater.Process.Technol. **251** (2018) 188–196.
3. Opt. Laser Technol. **115** (2019) 316-324.
4. Appl. Phys. Lett. **95** (2009) 111110.
5. ACS Appl. Mater. Interfaces. **2** (2010) 2377–2384.