USE OF PENNATE DIATOMS AS TEMPLATES FOR NANOTEXTURATION OF ELASTIC POLYMERS

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Nanotextured materials represent a very exciting subject of investigation in the field of material science due to the astonishing variety of morphology and physical-chemical properties. However, fabrication of assemblies reaching nanosize ordered features is particularly challenging. Man-made materials are therefore in strong competition with natural nanostructured materials, among which, diatoms play a significant role. Their siliceous frustules provide a unique natural source of three-dimensional nanostructured patterns with a considerable potential in different scientific fields and applications in nanotechnologies. Therefore diatoms have recently attracted attention of material engineers as promising templates for biomimetic fabrication. Among several biomimetic methods such as sol-gel technique or physical vapor deposition used for various natural templates, imprint lithography was recently applied to fabricate nanotextured polymers or metals based on diatom morphology. In the present work, we tested the reproducibility and preciseness of a soft lithographic technique using elastic polymer polydimethylsiloxane (PDMS Sylgard 184 ®) that was previously successfully used to replicate the micro- and nanoscale patterns from centric diatoms. In this approach, diatoms are immobilized on a glass surface coated with a UV-curable polymer and the diatom pattern is consequently transferred onto an elastic polymer producing a negative replica. The trials were focused on the optimisation of different parameters (pressure, temperature, ratio of curing agent and elastomer) at different steps (preparation of the master, PDMS molding and curing) of the molding process using freshwater pennate diatoms (e.g. *Encyonema silesiacum*, *Fragilaria* spp.). The results indicate that optimised parameters of the molding process allow replicating features of 50 nm. Such polymeric replicas with nano-scaled pattern can be potentially used in many different scientific fields; the possible applications include optical elements, nanofabrications, biosensing device components and nanoreactors. However, our study revealed some limitations regarding the size and morphology of the species used. Compared to previous works, the method seems to provide better results for large centric diatom species than for pennates that appeared rather fragile to resist the particular steps of the cast molding.