Development of novel Nanostructured surfaces using Residual Layer Free Nanoimprint Lithography and Metal Assisted Chemical Etching

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The fabrication of nano scale structures is important in many fields of technology such as photonics, electronics, energy conversion, energy storage, biosensors and biomimetic surfaces and many others. Therefore, the development and optimization of efficient and low-cost methods for the realization of nanostructured surfaces is very important. One of the most promising and efficient methods to produce and reproduce in a high throughput manner is nanoimprint lithography (NIL)[1]. Depending on the targeted (final) application, replicating nano structures by NIL without a residual layer is highly desirable in nanoimprint lithography and can greatly simplify the overall manufacturing processes[2]. In this work we discuss the imprinting conditions needed to achieve residual layer free (RLF) imprints when using thermal NIL and demonstrate micro/nano structured silicon wafers when combining RLF-NIL with Metal-Assisted Chemical Etching[3] (MACE). To achieve our final silicon nano patterned surfaces, after RLF-NIL a thin (30 nm) Au layer is deposited followed by a lift–off process to create Au patterns on our Si wafer. In the next step the samples were submerged into an aqueous solution mixture of HF: H_2O_2: H_2O. By emerging the Au/Si nano-patterned samples into the HF: H_2O_2: H_2O solution bath, the Au film acts as a catalyst so the Si beneath the Au film is etched. As a result, the pattern is transferred to the Si substrate.

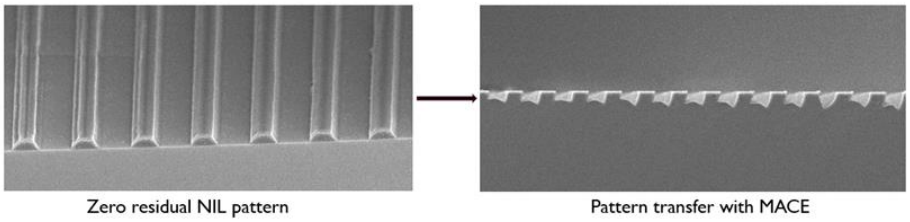

Figure 1: Cross section scanning electron microscope (SEM) images of Zero residual layer NIL patterns (left) and pattern transfer with MACE technique (right).

References

1. Schift, H. Nanoimprint lithography: An old story in modern times? A review. *J. Vac. Sci. Technol. B Microelectron. Nanom. Struct.* **26**, 458 (2008).
2. Yoon, H., Lee, H. & Lee, W. B. Toward residual-layer-free nanoimprint lithography in large-area fabrication. *Korea Aust. Rheol. J.* **26**, 39–48 (2014).
3. Han, H., Huang, Z. & Lee, W. Metal-assisted chemical etching of silicon and nanotechnology applications. *Nano Today* **9**, 271–304 (2014).

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