Study on the physical factors determining critical resolution of nanoimprint

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In nanoimprinting, the resin filling process into the mold cavity pattern and the demolding are the key processes.

In this presentation, we introduce the basic mechanisms of the resin filling process and the demolding process, and discuss the ultimate resolution of nanoimprinting based on the molecular behavior during resin filling and demolding based on the theoretical and experimental research results so far.

Calculations and experiments explain that the resolution limit of nanoimprinting depends on the molecular diameter of the processed material. Therefore, it is confirmed that the resolution of photonanoimprinting with smaller molecular weight resins and even direct nanoimprinting with inorganic materials is high.

On the other hand, with regard to demolding, it is expected that the friction state at the interface with the mold will be different depending on the molecular structure of the resin. Furthermore, it is shown that the increase in molecular weight reduces the interaction of the molecular chains, and friction and adhesion at the interface with the mold are the factors of demolding.

Based on these results, the outlook for future nanoimprinting materials and process technologies will also be discussed.

References

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