Lifetime Amelioration of Antireflection Structure Molds By Means of Partial-Filling Ultraviolet Nanoimprint Lithography

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ABSTRACT

Release coating layer (RCL) becomes an important element in ultraviolet nanoimprint lithography (UV-NIL) for preventing the adhesive resin from adhering to the surface of antireflection structures (ARS) mold. However, complete filling the resin of a high-aspect-ratio ARS mold during UV-NIL generates a strong release force (RF) that deteriorates the RCL and affects the lifetime of the ARS mold. In this paper, we proposed a technique of partial-filling UV-NIL in order to reduce the RF and consequently, ameliorate the lifetime of the ARS mold. The release and optical properties of the ARS were measured to determine the lifetime of the mold, and complete-filling UV-NIL was also executed for comparison. By means of partial-filling UV-NIL, we successfully fabricated ARS films with excellent performance up to the 150th imprint, i.e., reflectivity of 0.25 ± 0.15% and transmittance of 94.0 ± 0.50% at visible wavelengths, compared to complete-filling UV-NIL up to the 50th imprint.

KEYWORKS: Ultraviolet nanoimprint lithography (UV-NIL); Lifetime; Partial filling; Release force; Contact angle

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