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Atomic-Scale Imprinting into Amorphous Metals UDO SCHWARZ, RUI LI, GEORG SIMON, EMELY KINSER, ZE LIU, ZHENG CHEN, CHAO ZHOU, JONATHAN SINGER, CHINEDUM OSUJI, JAN SCHROERS, Yale University — Nanoimprinting by thermoplastic forming (TPF) has attracted significant attention in recent years due to its promise of low-cost fabrication of nanostructured devices. Usually performed using polymers, amorphous metals have been identified as a material class that might be even better suited for nanoimprinting due to a combination of mechanical properties and processing ability. Commonly referred to as metallic glasses, their featureless atomic structure suggests that there may not be an intrinsic size limit to the material's ability to replicate a mold. To study this hypothesis, we demonstrate atomic-scale imprinting into amorphous metals by TPF under ambient conditions. Atomic step edges of a $SrTiO_3$ (STO) single crystal used as mold were successfully imprinted into Pt-based bulk metallic glasses (BMGs) with high fidelity. Terraces on the BMG replicas possess atomic smoothness with sub-Angstrom roughness that is identical to the one measured on the STO mold. Systematic studies revealed that the quality of the replica depends on the loading rate during imprinting, that the same mold can be used multiple times without degradation of mold or replicas, and that the atomic-scale features on as-imprinted BMG surfaces has impressive long-term stability (months).

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