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Evidence for segregation of Te in "phase-change" thin chalcogenide Ge-Sb-Te films C. CABRAL, JR., L.. KRUSIN-ELBAUM, K. N. CHEN, M. COPEL, IBM T.J. Watson Research Center, J. BRULEY, IBM Hudson Valley Research Park, V. R. DELINE, IBM Almaden Research Center — The novel chalcogenide phase-change materials are promising candidates for new technologies such as nonvolatile memories and programmable switches in 3D integration and planar logic. They are typically thin Ge-Sb-Te (GST) films, where a thermally induced amorphous-to-crystalline phase transformation can be fast and reversible, with the corresponding large swing in resistance values between the two stable structural states. Here we report on the structural evolution of GST films during thermal cycling and demonstrate using high-resolution (0.5 nm focused probe STEM) scans that Te segregates to the grain boundaries at fairly low temperatures. We show that diffusion of Te along grain boundaries results in its pileup at the free surface and interaction with Ti in adhesion layers in device- compatible stacks. This is consistent with impeded grain growth and with post-crystallization stress release. This motion may impact the ultimate life-cycle of phase-change based devices and should guide the optimal GST material design.

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