Abstract Submitted
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Size-dependent melting of single and stacked silver alkanethiolate layers: experiment and phenomenological model[1] ZICHAO YE, Univ of Illinois - Urbana, LITO DE LA RAMA, SanDisk Corporation, LIANG HU, Intel Corporation, MIKHAIL EFREMOV, University of Wisconsin-Madison, LESLIE ALLEN, Univ of Illinois - Urbana — We report a systematic study of melting of silver alkanethiolate (AgSCn) lamellar crystals. A new synthesis method enables us to control their thickness by either modulating alkanethiol chain length (n = 7-18) or stacking them to a specific layer number (m = 1-10). Nanocalorimetry shows stepwise increase in the melting point, T_m, of single layer AgSCn as an increment of chain length. Layer stacking also results in a size-dependent melting. An odd/even alternation is observed in the T_m of 2, 3, and 4-layer lamellae, but absent in that of single and multilayer samples. We develop a phenomenological model for lamellae melting based on the cumulative excess free energy contributions of four spatially separate regions in AgSCn crystal: free surface, Ag−S central plane, substrate interface, and interlayer interface. Surface excess free energy is revealed to be independent of chain length. The selective appearance of the odd/even effect is due to the significant stabilization of interlayer interfaces of odd-chain samples, possibly due to registration/packing. Such interface stabilization occurs most significantly for 2-layer samples. XRD results support the model as the measured van der Waals gap is smaller for crystals with odd chains.

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