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Thermal conductivity behavior of superatom molecular crystals WEE-LIAT ONG, Columbia University / Carnegie Mellon University, EVAN OBRIEN, Columbia University, PATRICK DOUGHERTY, JILLIAN EPSTEIN, C. FRED HIGGS, ALAN MCGAUGHEY, Carnegie Mellon University, XAVIER ROY, Columbia University, JONATHAN MALEN, Carnegie Mellon University — The room temperature thermal conductivity of several superatom molecular crystals (SMCs) are measured and found to be below 0.3 W/mK. The trend of room temperature thermal conductivity of the different crystals agree well with their sound speeds obtained independently using nano-indentation. These crystals, however, can exhibit non-crystalline thermal conductivity behavior depending on their constituent elements. A superatom is a cluster of atoms that acts as a stable entity [e.g., fullerenes (C60)]. By careful mixing and assembling these nano-sized superatoms, the resulting superatom-assembled materials hold promises for improving various technological devices. Organic-inorganic superatoms can assemble into unary SMCs or co-crystallized with C60 superatoms into binary SMCs. Thermal transport is of considerable interest with possible new physics in these hierarchically atomic precise crystals in the low temperature regime. The thermal conductivity of the SMCs are measured using the frequency domain thermoreflectance setup. Unary SMCs exhibit an almost invariant thermal conductivity down to a temperature of 150 K. Binary SMCs, however, can either show a crystalline-like increase or an amorphous-like decrease with decreasing temperature.

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