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Optical and structural properties of $(\text{III-V})_x(\text{IV})_{5-2x}$ alloys¹ JOSÉ MENÉNDEZ, PATRICK SIMS, LIYING JIANG, JOHN KOUVETAKIS, Arizona State University — A novel class of (III-V)-IV semiconductor alloys was recently introduced by our group. The alloys are designed to incorporate entire $(\text{IV})_3\text{-V-III}$ tetrahedral building blocks formed in the gas phase by reactions of $(\text{V})\text{-(IV-H}_3)_3$ molecules with group-III atomic beams. This structure leads to the highest possible concentration of isolated III-V pairs in a group-IV matrix. Thick, highly crystalline films have been grown on Si and Ge substrates using the group-III elements In and Al, the group-V elements N, P, and As, and the group-IV elements Si and Ge. Results from an array of structural and optical characterization probes will be compared with theoretically proposed structures and predicted optical properties for these new alloys. The existence of III-V compounds with lattice constants very similar to those of elemental Si and Ge implies that the corresponding $(\text{III-V})_x(\text{IV})_{5-2x}$ alloy will have a tunable electronic structure at a fixed lattice constant, a property that may find applications in areas such as photovoltaics.

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