Sometimes intermetallic phases can adopt bewildering structures with hundreds or thousands of atoms per unit cell, or no detectable 3-dimensional periodicity. Using quantum mechanical calculations as a guide to view these structures, we will see one reason that such structures form: many complex intermetallics are, at heart, simple structures that have made room for extra electrons through the formation of interfaces. The Nowotny chimney ladder phases are an example: these are beautiful examples of two component composite crystals, in which the two incommensurable components form helical motifs. Electronic structure calculations reveal that the complex chimney ladder structures each chimney ladder consists of slabs of TiSi₂ structure type. The interfaces between the slabs act as electron sinks to achieve electron counts optimal to the TiSi₂ structure. The same thing happens in giant cubic intermetallic phases based on Friauf polyhedra, such as NaCd₂. This phase the NaCd₂ structure, with over 1000 atoms per unit cell, is also built from blocks cut from a simple structure type, this time the MgCu₂ type. Extra electrons are accommodated by the interfaces between MgCu₂-type blocks. While in the chimney ladders, the blocks are separated by planar interfaces, the interfaces in NaCd₂ form a minimal surface, the P surface.

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