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Icosahedral phase strengthened nanocomposites for structural components

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ICOSAHEDRAL PHASE STRENGTHENED NANOCOMPOSITES FOR STRUCTURAL COMPONENTS

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The discovery of quasicrystals (QCs) in rapidly solidified Al-Mn alloys has led to a fundamental change in the way that we view the structural spectrum from the amorphous to the crystalline state. This also opened up the possibility of a new class of aluminum-based alloys, because the lack of long-range order in QCs precludes the operation of the usual plastic deformation mechanisms. While a significant amount of work has been done in this area with regards to understanding QCs at the atomic level, very little work has been performed on large-scale materials because the desired microstructures tend to require high cooling rates and the QCs tend to decompose during subsequent thermomechanical processing. In recent work, 25.4 cm diameter billets of Al-Cr-Mn-X alloys have been produced via gas-atomization and consolidation, and these have been subsequently processed by warm extrusion and forging. Preliminary observations indicate that these alloys exhibit good microstructural stability, promising mechanical and physical properties, and remarkable corrosion resistance.