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A method for obtaining nano-sized structures in bulk materials with polymorphic metallic matrixes

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There are some methods to form nanostructures in metal-based materials the common feature of which is their applicability for obtaining only thin films or surface layers. A novel method to provide nano-sized structures in bulk alloys, composites, sintered and 3-D printed materials with polymorphic metallic matrixes was proposed and applied to industrial cast irons and alloy structural steels. The method is based on optimal isothermal holding during cooling or heating of a product unlimited form and size after or before its austenitizing. Mathematical relations between the optimal holding temperatures and durations providing targeted grain sizes were derived. Over threefold increase in the impact resistance for the cast irons and steels was reached. The above performance improvements are accompanied by the materials chemical and structural homogenizing. Necessity of the phenomena revealed detail investigations is emphasized and prospects of the method further employments are discussed.

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