

Age Strengthening in Gray Cast Iron: Manufacturing Application, Truths, and Myths

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Abstract: Despite public perception that cast iron is no longer a significant engineering material, more of it is produced in a year than any other cast material group [1]. Research on and advancements of the various cast iron alloys are still ongoing. One such contemporary research focus was directed towards understanding age strengthening (precipitation hardening) of gray cast iron and its influence on the material's machinability. The strengthening process in cast iron is from nitride precipitation describable by Avrami-Johnson-Mehl kinetics and can occur at room temperature. Age strengthening can improve machinability in the case of irons with free (not in pearlite) ferrite in the microstructure but decrease the machinability if the microstructure contains no free ferrite. A summary of the gray cast iron age strengthening research is presented. Emphasis is placed on practical manufacturing results with brief discussion of the myth that residual stresses solely cause the strengthening. Also presented, for the first time, is a brief retraction of a previously published [2] idea that tool wear is minimized when machining castings aged for only 5 days at room temperature.

Keywords: Cast Iron; Age Strengthening; Precipitation Hardening; Machinability; Tool Wear

References:

- [1] "44th Census of World Casting Production," *Modern Casting*, pp. 23-27 (December 2010).
- [2] Teague, J.A., Richards, V.L., Lekakh, S.N., and Peaslee, K.D., "Age Strengthening and Machinability Interactions in Gray Cast Iron," *AFS Transactions*, **117** (2009).

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