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# Composites of copper and cast iron fabricated via the liquid: In the vicinity of the limits of strength in a non-deformed condition

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## Abstract

In this study, the effect of copper on the structure and properties of cast iron is discussed. The experimental samples, with copper content from 0.09 wt% to 14.2 wt%, were synthesized in an induction furnace. The structure of the samples was characterized using light microscopy (LM), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The influence of copper on the volume fraction of graphite and pearlite, and its interlamellar spacing and the tendency of the composites to form a white iron structure are discussed. In particular, precipitation of ε-copper was investigated. For a better understanding of the structural evolution, the isoplethal section of 3 wt% C in the Fe-Cu-C phase diagram was calculated. The hardness, tensile strength, friction coefficient and wear resistance of the composites were measured. The addition of copper leads to hardening and strengthening of the composites. However, at a high copper content, the strength of alloys decreases due to the formation of a brittle white iron structure. Copper has a positive effect on the friction coefficient and reduces wear resistance by promoting the formation of ledeburite.

**Keywords:** cast iron, copper, structure, properties, ε-copper

## 1 Introduction

Copper is typically not considered as a major alloying element of steels and cast irons. The content of copper in these alloys rarely exceeds 2%. However, the positive effect of small additions of copper on the mechanical and functional properties has been observed by numerous

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