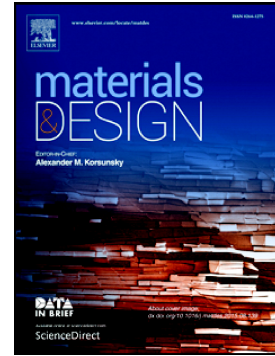


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## Identification of Copper precipitates in Scrap Based Recycled Low Carbon Rebar Steel

A. Ramadan<sup>1</sup>, A. Y. Shash<sup>2</sup>, I. S. El-Mahallawi<sup>2</sup>, D. Senk<sup>3</sup> and T. Mattar<sup>4</sup>

<sup>1</sup>) Beshay Steel, Industrial Zone, 32897 Sadaat City, Egypt

<sup>2</sup>) Faculty of Engineering Cairo University, 12316 Giza, Egypt

<sup>3</sup>) Institute of Ferrous Metallurgy, RWTH-Aachen University, 52072 Aachen, Germany

<sup>4</sup>) Central Metallurgical Research and Development Institute, 11421 Helwan, Egypt

**Corresponding Author: Dr.-Ing. A. Y. Shash,**

**E-Mail: ahmed.shash@cu.edu.eg, Tel: +20-2-3567858, Fax: +20-2-38332078**

### Abstract

This work assesses the effect of increased copper content appearing in recycled steel on the type and morphology of formed precipitates and hence on the steelmaking process and the final product's mechanical properties. The tramp elements (copper, lead and tin) segregate at the grain boundaries as brittle phases leading to reduction in the impact toughness and the ductility. Copper precipitates were found at the grain boundaries and through the grains around manganese sulphides in different morphologies. The chemical composition and shape of these precipitates depend on the cooling rate and other elements as nickel, silicon, sulphur and manganese. The copper precipitates act as brittle phases leading to reduction in the impact toughness and ductility.

The potential of the accumulation of the residual copper for both hot rolled and Tempcore processed steel, was assessed. The results show that by applying Tempcore process a more uniform and finer distribution of copper precipitates is formed, with change in their morphology from plate- like to spherical shape. The results also show that the addition of nickel and silicon changes the harmful brittle copper precipitates to a more complex form with the formula  $\text{NiSiMn}(\text{MnCuS})(\text{Cu}_3\text{P})$ , which is surrounded by a  $\text{NiSiMnCu}$  solid solution.

**Keywords:** Copper precipitates, Tempcore process, Transition Temperature, Steelmaking, Scrap recycling.

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