

Analysis of the Binding Mechanism for Compound Casting Iron- and Copper-Base Alloys

Motivation

Using compound materials allows for tailor-made solutions to complex requirement profiles. A compound of materials that is frequently used in industry is copper- and steel-based alloys. This combines the high strength and low cost of steel and cast iron with the high conductivity for heat and electricity of copper

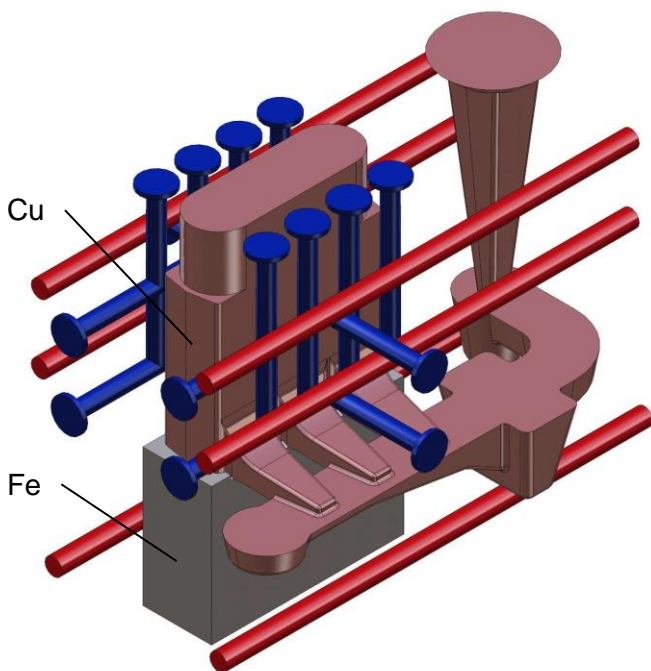


Figure 1: Setup for compound-casting of Cu-Fe bimetals

Solution Approach

The research program aims to establish a model predicting compound strength and metallurgical characteristics of cast Fe-Cu compounds, considering material and process related parameters. Casting will be carried out in a static permanent mold process. The Fe substrate is inserted in the mold and the Cu-alloy is cast adjacent to it. Varying process parameters yield cause-effect-chains linking those to bonding strength and metallurgical appearance.

As a starting point, miniature casting experiments are performed in order to identify the process window of compound forming by varying the temperature-time-profile.

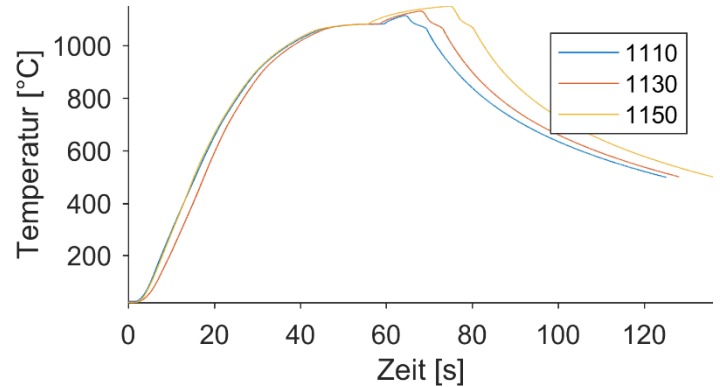


Figure 2: Variation of the maximum temperature in compound-casting

Results

Using appropriate boundary conditions, for example exceeding a limiting temperature, compound formation between substrate Fe and Cu melt is established.

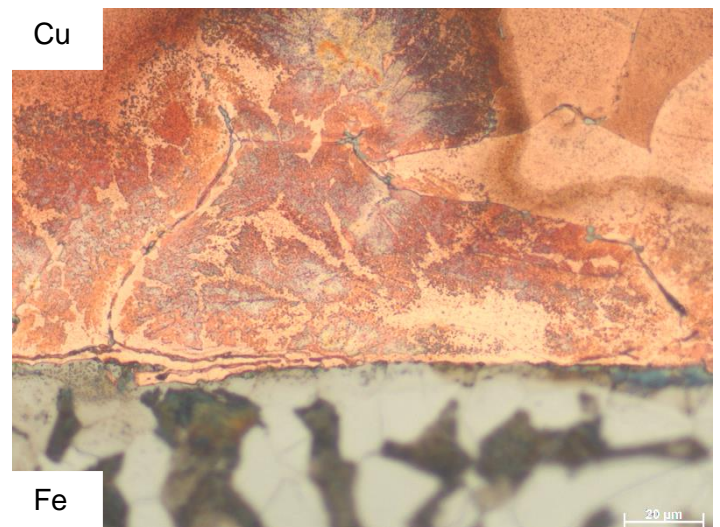


Figure 3: Micrograph of Cu-ETP/Fe-layered compound