Towards novel in-situ composites: MAB nanolaminate-reinforced FCI quasicrystal in multi-phase aluminum alloys.

Autorzy

Piotr Józef Bardziński

Rok wydania

2021

Czasopismo

Journal of Alloys and Compounds

Numer woluminu

871

Strony

159511/1-159511/8

DOI

10.1016/j.jallcom.2021.159511

Kolekcja

Naukowa

Język

Angielski

Typ publikacji

Artykuł

Streszczenie

A range of new in situ composites with prospective application for low-density ballistic shielding was investigated. The beneficial mechanical properties will come from the co-existence of two phases: impact-resistant face-centered icosahedral (FCI) and Fe_2AlB_2. The aim of the current study was the investigation of phase equilibria in Al-Cu-Fe-B system. Each of the elements in Al-Cu-Fe base alloy was doped with boron and the alloys were produced by means of suction casting. The composition impact on microstructure, accompanying phases identification and hardness were discussed in detail. The compositional FCI phase stability area was found to be smaller than predicted from atomic size constraint imposed by Hume-Rothery criteria for ternary system. Primary phases were Fe_2AlB_2 or Fe_4Al_{13} in B-doped alloys. It was found that atomic positions of B in Fe_2AlB_2 phase can be occupied by Cu, what opens new route of tailoring its properties. B:Fe and B:Cu substiution in the 4–10 at% range promotes the growth of AlB_2 phase from small tabular precipitates to long needles, what is correlated with the reduction of overall hardness. B:Al substitution leads to progressive increase in thickness of Fe_2AlB_2 lamellae that accompanies the hardness improvement. It was found that dominant factor contributing to overall alloy hardness was the shape of reinforcing Ψ and ζ grains rather than volume fraction of constituent phases.

Słowa kluczowe

Aluminum alloys, in-situ composites, MAB phase, Nanolaminate, Quasicrystal, structure

Adres publiczny

http://dx.doi.org/10.1016/j.jallcom.2021.159511

Strona internetowa wydawcy

http://www.elsevier.com