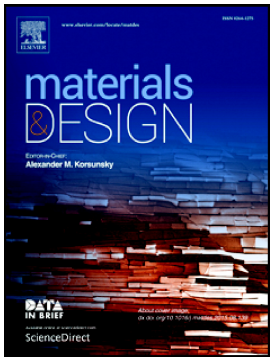

An Al-17Fe alloy with high ductility and excellent thermal stability

F. Průša, V. Kučera, D. Vojtěch

PII: S0264-1275(17)30695-0
DOI: doi: 10.1016/j.matdes.2017.07.027
Reference: JMADE 3217

To appear in: *Materials & Design*

Received date: 2 May 2017
Revised date: 29 June 2017
Accepted date: 14 July 2017

Please cite this article as: F. Průša, V. Kučera, D. Vojtěch , An Al-17Fe alloy with high ductility and excellent thermal stability, *Materials & Design* (2017), doi: 10.1016/j.matdes.2017.07.027

An Al-17Fe alloy with high ductility and excellent thermal stability

F. Průša[1*], V. Kučera[1], D. Vojtěch[1]

[1]Department of Metals and Corrosion Engineering, University of Chemistry and Technology in Prague, Prague, Technická 5, 166 28, *Filip.Prusa@vscht.cz

Abstract

In this work, Al-17Fe alloys (wt.%) were prepared by a combination of different techniques, including centrifugal atomization and mechanical milling, followed by compaction via hot extrusion or advanced spark plasma sintering. Both alloys exhibited a satisfactory hardness of approximately 120 HV 5, which is almost identical to the reference Al-12Si-1Cu-1Mg-1Ni casting alloy. However, when annealed at 400 °C for up to 100 h, the investigated alloys showed excellent thermal stability, which manifested as an almost negligible change in the initial hardness. In comparison, the reference Al-12Si-1Cu-1Mg-1Ni alloy softened considerably, with a decrease in hardness by almost 50 % to 63 HV 5. Compressive stress-strain tests of compact samples at laboratory temperature or at an elevated temperature of 400 °C in the initial state and after 100 h of annealing at 400 °C confirmed similar or superior ultimate compressive and compressive yield strengths for both the Al-17Fe alloys compared to the reference Al-12Si-1Cu-1Mg-1Ni alloy, which softened considerably when annealed at the elevated temperatures. More importantly, the centrifugally atomized and hot-extruded Al-17Fe alloy exhibited outstanding ductility, reaching 34 %, even when compressively tested at laboratory temperature.

Keywords: centrifugal atomization, mechanical milling, extrusion, spark plasma sintering, thermal stability.

Introduction

Increasing demand for special aluminium alloys, mainly utilized by the automotive industry, has increased the total production of aluminium alloys, which already exceed the production of steel and