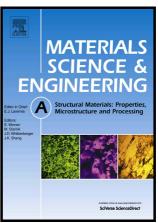
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ACCEPTED MANUSCRIPT

Microstructure and mechanical properties of 7075-Al alloy joint ultrasonically soldered

with Ni-foam/Sn composite solder

Yong Xiao^{a*}, Shan Li^a, Ziqi Wang^b, Yong Xiao^{b*}, Zhipeng Song^a, Yongning Mao^a, Mingyu Li^b

^aSchool of Materials Science and Engineering, Wuhan University of Technology, Wuhan

430070, China

^bShenzhen Graduate School, Harbin Institute of Technology, Shenzhen 518055, China

yongxiao@whut.edu.cn

yong.xiao@hit.edu.cn

*Corresponding author. Tel.: +86 13428935574

*Corresponding author. Tel.: +86 15815518461

Abstract

Ultrasound-assisted soldering of 7075 Al alloy was performed using Ni-foam

reinforced Sn composite solder. The phase composition, interfacial microstructure and

mechanical properties of Al/Ni-Sn/Al joints soldered for different times were investigated.

Results showed that, the bonding ratio of joint was increased with increasing ultrasonic

soldering time and was stabled at approximately 98 % when the soldering time was longer

than 20 s. The Ni-foam in joint was compressed into a strip type and a Ni₃Sn₄ intermetallic

compound (IMC) layer was formed on the Ni skeleton surface, whilst an Al₃Ni IMC layer was

formed on the Al substrate surface. The Al₃Ni phase was dot-distributed in joint soldered for 5

s then formed continuously in joint soldered for 15 s. However, further increasing the

soldering time to 30 s resulted in the drastic growth of Al₃Ni IMC layer, accompanied with

the depletion of Ni₃Sn₄ phase. The formation and microstructure evolution mechanisms of the

Al₃Ni IMC layer was discussed. The measured shear strength of joint was first increased then

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