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Structure and Environment 2024, vol. 16, (2), pp. 97-110, Article number: el 009
https://doi.org/10.30540/sae-2024-009

Structure and Environment
ISSN 2081-1500
e-ISSN 2657-6902
https://content.sciendo.com/sae
https://sae.tu.kielce.pl

sciendo

Kielce University of Technology

DOI: 10.30540/sae-2024-009

SELECTED MICROSTRUCTURAL PHENOMENA IN FSW JOINTS

WYBRANE ZAGADNIENIA MIKROSTRUKTURY SPOIN WYKONANYCH W TECHNOLOGII FSW

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Abstract

The article is a literature review on selected phenomena leading to microstructural changes in material welded using the friction stir welding (FSW) method. Particular attention was paid to the phenomena of grains recrystallization, as well as dissolution and reprecipitation of second phase particles, resulting from temperature changes during FSW. Temperature transformations in different zones of the FSW joints were characterized. The role of base material phase transformation in the formation of new particles is discussed. In the tested aluminum alloys and stainless steels, this process was particularly intensified in the heat affected zone (HAZ). In areas subjected to high temperature and significant plastic deformation (nugget zone and thermomechanically affected zone), this phenomenon did not occur or was characterized by small intensity. It was indicated that the phenomenon of particle formation clearly affects the strength parameters of the joint.

Keywords: Friction Stir Welding (FSW), microstructure, grain, recrystallization, precipitation, strengthening particle

Streszczenie

W artykule przedstawiono przegląd literatury dotyczący wybranych zjawisk prowadzących do zmian mikrostrukturalnych w metalach spawanych metodą zgrzewania tarciowego (FSW). Szczególną uwagę zwrócono na zjawiska rekrystalizacji ziaren oraz rozpuszczania i ponownego wytrącania cząstek drugiej fazy, zachodzące jako efekt zmian temperatury podczas FSW. Scharakteryzowano zmiany temperatury w różnych strefach złączy FSW. Omówiono rolę przemian fazowych materiału podstawowego w powstawaniu nowych cząstek. W badanych stopach aluminium i stalach nierdzewnych proces ten był szczególnie nasilony w strefie wpływu ciepła (SWC). W obszarach narażonych na działanie wysokiej temperatury i znacznych odkształceń plastycznych (jądro zgrzeiny i strefa uplastycznienia termomechanicznego) zjawisko to nie występowało lub charakteryzowało się niewielkim natężeniem. Wykazano, że zjawisko tworzenia cząstek wyraźnie wpływa na parametry wytrzymałościowe złącza.

Słowa kluczowe: zgrzewanie tarciowe (FSW), mikrostruktura, ziarno, rekrystalizacja, wydzielenie, utwardzanie wydzieleniowe

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