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Lecture

Friction Stir Processed Al alloys for damage mitigation and healing

Wednesday (06.11.2019)

16:40 - 17:00

Part of:

C.2: Session 2 Session

Wednesday (06.11.2019)

16:40 - 18:00

During the service life of an aluminum part, damage initiates on large iron-rich intermetallic particles and leads to final failure by growth of these cavities and their coalescence. This damage leads to significant economic loss for their replacement. A first step towards an increase in fracture strain is to decrease the size of these intermetallic particles. This has been shown to be highly efficient when 6xxx series Al alloys are processed by Friction Stir Processing (FSP) [1]. A second step, which is the aim of the present work and related to the ERC-ALUFIX project, is to

integrate particles in the aluminum alloy by the very same process. These newly integrated particles can either favor crack deviation in order to increase toughness or be used for damage healing. Crack deviation can be favored by the integration of NiTi particles surrounded by controlled internal stresses. The internal stresses are introduced via pre-straining and shape recovery of the embedded NiTi particles. In addition, the NiTi particles enhance the mechanical strength of the composite. A homogenous NiTi distribution and a good bonding at the Al/NiTi interface is the key to a successful crack deviation. This is a challenge in a 7075 Al matrix while easily achievable in a 1050 Al matrix. An alternative is to introduce healing particles in the Al matrix and perform a healing treatment to heal micro-damage. Here the damage healing is assessed through in-situ heating in the TEM and X-Ray nano holotomograph. It was found that small damage (up to 1 μm size) can be healed at 400°C within 10 min of heat treatment.

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