# On the fatigue crack growth resistance of aluminum matrix composites reinforced by shape memory alloys

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Particulate reinforcements are widely used in aluminum alloys to increase their strength. However, it can also be used to enhance fatigue crack resistance. In the field of metal matrix composites (MMC), shape memory alloys (SMAs), when used as reinforcements, allow tailoring the damage mechanisms due to their shape memory effect (SME). The SME can be used to generate local internal stresses in the vicinity of reinforcements, allowing to attract or repel the crack during its propagation. Therefore, the mechanism of crack deviation will postpone the final failure. In the present work, nitinol (NiTi) particles were used as reinforcements for Al7075, and the Al7075/NiTi composites were manufactured via Friction Stir Processing (FSP). FSP allows to homogeneously distribute the reinforcements in the aluminum matrix and mitigate interfacial intermetallic formation. The SME was obtained through a pre-straining, followed by a heat treatment. The analysis of fatigue crack growth (FCG) tests confirms the enhancement of crack resistance by deviation and branching in the presence of internal stresses. Moreover, digital image correlation (DIC) analysis allows for understanding of the plasticity and damage mechanism that occurs at the crack tip during its propagation.

**Keywords:** Fatigue crack growth, Shape Memory Alloys, Internal Stresses, Crack deviation