



## **MECHANICAL ENGINEERING PhD SEMINAR**

**Thursday, October 29 2026 at 13:30, Lady Davis Building, Auditorium 250**

### **Welding “Unweldable” Aluminum Alloys**

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Aluminum alloy AA7075 offers a high strength-to-weight ratio, making it attractive for lightweight structures. However, fusion welding can cause cracking during solidification and reduce joint strength. Filler wires containing titanium carbide (TiC) nanoparticles can suppress this cracking, but questions remain about the resulting microstructure, mechanical performance and sensitivity to welding conditions.

This seminar presents four complementary studies addressing these questions.

First, microscopy and crystal-structure analysis identify the compounds formed in the weld, including an iron-rich phase with a previously unreported crystal structure. These findings help explain how welding changes the material and provide a basis for understanding its performance.

Second, mechanical testing evaluates joint strength and performance under repeated loading. Following post-weld heat treatment, joints made with the TiC-containing filler reached approximately 97% of the measured base-metal ultimate tensile strength. Separate tests assess fatigue life and crack growth in as-welded joints.

Third, an instrumented test system compares sensitivity to cracking as weld metal solidifies. A new protocol gradually reduces the joint-opening speed during a single weld until crack growth stops. This identifies a speed range for subsequent constant-speed tests, helping reduce exploratory testing when comparing filler wires and welding conditions.

Fourth, wire arc additive manufacturing is used to build an AA7075–TiC wall layer by layer. The wall demonstrates initial feasibility, but its strength varies substantially from bottom to top, highlighting the challenge of achieving uniform properties throughout a printed component.

Note: the seminar will be given in Hebrew