AMAP
Advanced Metals and Processes

# Invitation to the 103. AMAP Colloquium

Presentation by


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## Friction Extrusion: An Emerging Solid-State Technique for Processing, Recycling, Upcycling and Mechanical Alloying of Aluminum Alloys.

on Thursday, ***April 23rd, 2025 at 4.00 pm***
with subsequent discussion at AMAP

All interested persons are sincerely invited to the AMAP foyer.
Snacks and refreshments will be available.


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# Friction Extrusion: An Emerging Solid-State Technique for Processing, Recycling, Upcycling and Mechanical Alloying of Aluminum Alloys

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## Abstract

As a friction-based solid-state process, Friction Extrusion (FE) enables the fabrication of advanced materials utilizing a non-consumable tool to generate both severe plastic deformation and frictional heating for processing the materials. The technique is highly adaptable for processing solid materials, chips and powders into extrudates in various shapes, such as circular, rectangular, profiled and hollow structures. Figure 1 illustrates the mechanism for rod production: a die applies pressure to the feedstock material inside a rotating container, generating enough heat to soften the material via plastic deformation. This plasticized material is then forced through the die's opening, resulting in a consolidated rod.

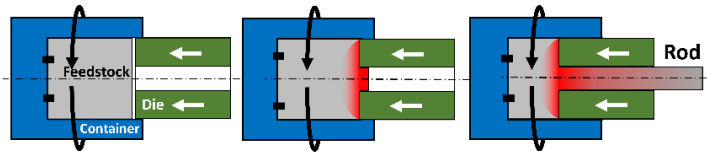


Figure 1. Schematic illustration of the Friction Extrusion process

FE eliminates the need for preheating because the heat is generated through friction between the die and the material during the process. This significantly reduces energy consumption and requires lower axial force than conventional methods, making the process both energy-efficient and sustainable. Driven by severe plastic deformation at an elevated process temperature, the FE and its variant can be utilized for:

1. Processing various feedstocks (solid, chips and powder) into solid and hollow extrudates in various shapes with improved properties.

2. Recycling end-of-life materials into valuable products with the same composition, such as recycling machining chips into wire or rod.

3. Upcycling end-of-life materials into higher-grade materials, such as upcycling 6xxx series chips with Zn addition to produce higher strength 7xxx extrudates.

4. Mechanical alloying of materials with strengthening particles or other materials to produce metal matrix composite (MMC), oxide dispersion-strengthened (ODS) materials or other alloys, such entropy alloys.