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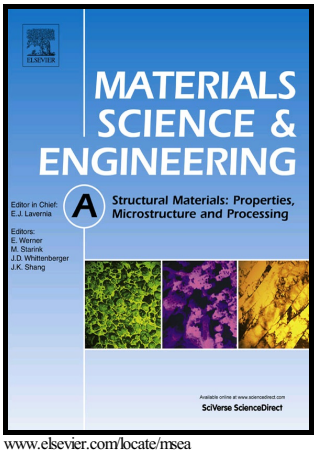

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ABSTRACT

In an effort to develop high strength aluminum alloys, a near-AA5083 Al-Mg alloy powder was cryomilled in liquid nitrogen and consolidated by vacuum hot-pressing (VHP). The composition of the Al-Mg alloy was designed to minimize intermetallic particles that often lead to premature fracture especially when flow strength is high. The as-VHP material had poor ductility and therefore was extruded under different conditions to obtain a good combination of tensile strength and ductility. The microstructure of samples were characterized using X-ray diffraction, EBSD, FIB induced secondary electron orientation contrast imaging, and TEM techniques, which together provided unique assessment at multiple length scales. The samples exhibited a wide range of grain sizes that could be binned into three different groups: i) grain sizes of 50-100 nm, (ii) sizes in the 100-300 nm range, and (iii) elongated larger grains with widths in the range 0.5 to 2 μm. Room temperature tensile tests with cylindrical dog-bone geometry indicated a high ultimate strength of 730-770 MPa and reproducible elongation to failure of about 3 - 4%. This combination of strength and ductility in the material are some of the best that have been reported for alloys close to the weldable and corrosion resistant AA5083 composition, and likely a result of the multi-scale microstructure resulting from the processing route.

Keywords: Nanocrystalline, AA5083, cryomilling, extrusion, multiscale, ultrafine grained.