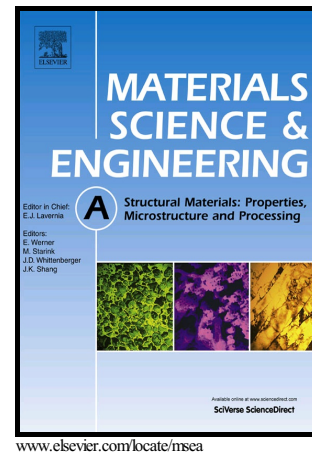


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## An approach for room-temperature multi-directional forging of pure titanium for strengthening

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**Abstract** Commercially pure Ti grade 2 was multi-directionally forged (MDFed) at room temperature. MDFing could be successfully carried out without any cracking to a cumulative strain of  $\Sigma\Delta\varepsilon = 2.0$ . Ultrafine-grained (UFGed) structure gradually developed with increasing cumulative strain mainly by mechanical twinning and kinking. An average grain size of approximately 400 nm was attained. The mechanical properties were drastically modified by the grain refinement and a superior balance of tensile strength and ductility, 710 MPa and 21%, was achieved. Additional cold rolling of the UFGed Ti possessed further better mechanical properties of 930 MPa tensile strength and 19 % ductility.

**Keywords:** severe plastic deformation; multi-directional forging; titanium; ultrafine grain; mechanical properties; twin

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