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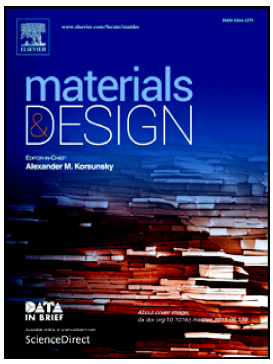

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Emad M.M. Ewais, Nada H.A. Besisa

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Tailoring of magnesium aluminum titanate based ceramics from aluminum dross

Emad M.M. Ewais*[a], Nada H.A. Besisa[a]

[a]Refractory& Ceramic Materials Division (RCMD), Central Metallurgical R&D Institute (CMRDI), P.O. Box 87 Helwan, 11421 Cairo, Egypt

*Author to whom correspondence should be addressed (E-mail: dr_ewais@hotmail.com)

Abstract

Magnesium aluminum titanate ($Mg_{0.3}Al_{1.4}Ti_{1.3}O_5$ and $MgAl_8Ti_6O_{25}$) "MAT" based ceramics were successfully prepared by reaction sintering at a temperature of 1300 ^oC for 6h starting from aluminum dross waste and rutile ore powders. Different mixtures of dross-(0-60 wt %) rutile were prepared. The obtained ceramic composites were characterized by XRD and FE-SEM. Physical and mechanical properties of MAT based ceramics were also investigated as well as the linear thermal expansion. XRD data illustrated that the solid solutions of composition $Mg_{0.3}Al_{1.4}Ti_{1.3}O_5$ and $MgAl_8Ti_6O_{25}$ were initially formed in the specimen containing 10% rutile(R). Afterward, their amount increased with further addition of rutile up to 60%. The best values of densification parameters (≈2.76 g/cm^3 bulk density and ≈12.46% apparent porosity) were recorded for specimen containing 20% rutile. In contrast, 50% and 60% R added samples, which are mainly composed of $Mg_{0.3}Al_{1.4}Ti_{1.3}O_5$, $MgAl_8Ti_6O_{25}$ and traces of TiO_2 exhibited density of 2.31 g/cm^3 and 2.5 g/cm^3, respectively. Moreover, the obtained samples present thermal stability even at high temperatures. No decomposition was observed over a range of temperature of RT-1200 ^oC. In addition, the TEC's of the obtained samples have lower values than those of AT ceramics. As a consequence, the solid state sintering of aluminum dross waste and rutile ore can be considered as a promising way to produce a new advanced ceramic materials based on MAT. Also, using this waste has two intrinsic impacts. One over the nature by reusing this waste and the second on production cost.

Keywords: Aluminum dross waste; Rutile ore; AT-MT (Al_2TiO_5-$MgTi_2O_5$); Thermal expansion; Microcracks.