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Yasuo Hikichi^a, Keiji Daimon^a, Toshitaka Ota^a

^a Nagoya Institute of Technology, Japan

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LaPO₄-CONTAINING MACHINABLE Al₂O₃ CERAMICS

*Yasuo Hikichi, Keiji Daimon, and Toshitaka Ota
Nagoya Institute of Technology, Japan*

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The melting temperature and thermal expansion coefficient of monoclinic LaPO₄ were almost identical to those of alumina. Davis et al.¹ reported that LaPO₄-Al₂O₃ composite was found to be machinable. However, there have been a few systematic studies on the (1-x)LaPO₄-xAl₂O₃ (x = 0 to 1 mass) composite ceramics, including fabrication methods and their material properties. Several of these are discussed in this article. Mixtures of (1-x)LaPO₄ and xAl₂O₃ (x = 0 to 1 mass) were dry-pressed to disks or bars. Relative density larger than 94% was achieved when the specimens were fired at 1600°C for 5 h in air. The sintered ceramics (x = 0 to 0.7) were found to be machinable; that is, they could be drilled using WC drill. Thermal and mechanical properties of the sintered composites were in the ranges; $10.0 \times 10^{-6}/^{\circ}\text{C}$ (x = 0) to $9.0 \times 10^{-6}/^{\circ}\text{C}$ (x = 1) (linear thermal expansion coefficient at 200–1000°C); 5.0 (x = 0) to 43 W/(m·K) (x = 1) (thermal conductivity at 25°C); 100 (x = 0) to 350 MPa (x = 1) (bending strength), 5 (x = 0) to 17 GPa (x = 1) (Vickers hardness); and 1.8 (x = 0) to 3.8 MPa·m^{0.5} (x = 1) (fracture toughness).

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Address correspondence to Yasuo Hikichi, Department of Material Science and Engineering, Nagoya Institute of Technology, Gokiso-cho, Showa-ku, Nagoya 466-8555, Japan.
E-mail: hikichi@mse.nitech.ac.jp