

# Manufacture of cordierite parts by robocasting from recycled powders

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## Abstract

Advanced ceramics exhibit remarkable properties, such as high mechanical strength, thermal conductivity, or wear resistance. Therefore, they are used as critical components for specific applications in the fields of aerospace, automotive, energy production or cutting tools. Silicate ceramics usually present less efficient properties. However, they can be an economically advantageous alternative to technical ceramics in many applications operating at room or moderate temperatures (< 1000 °C). Moreover, regarding the environmental aspect, silicate ceramics are processed from natural abundant mineral resources, show a high recyclability, and require moderate sintering temperatures. One potential technical use of silicate ceramics is the manufacture of gas cleaning devices, such as catalyst substrates or particulate filters, as it is the case for cordierite in the automotive industry. The expansion of the use of these devices in other sectors goes through the development of low-cost flexible manufacturing technologies and the improvement of the efficiency of the devices through the design of components with complex architectures.

On that purpose, the aim of this study is to demonstrate the possibility to manufacture complex cordierite parts by robocasting. Moreover, this work focuses on the use of an already-formed cordierite powder recycled from industrial wastes. First, the sinterability of recycled cordierite is studied and compared with a commercial cordierite. Next, the preparation and characterization of a stable ink of cordierite powder with a suitable rheological behaviour for the robocasting process is achieved. Finally, a comparison is made, regarding the final properties (density/porosity, coefficient of thermal expansion and Young's modulus), between printed parts and parts obtained by uniaxial pressing, after sintering at 1300 °C for 4 hours.