

# Environmental Assessment of Sintering of Ceramic Capacitors

How to evaluate cost-effectiveness of sintering techniques?

To evaluate the cost-effectiveness, the concept of Net Present Value (NPV) which measures the profitability derived from adopting a particular sintering technique, must be known. This is computed by discounting the cash flow at the specified rate of return.

What are the environmental benefits of sintering?

Using renewable energy sources like hydroelectricity, wind, and solar means the high electricity consumption of sintering processes has a low environmental impact compared to alternative manufacturing processes.

How does sintering affect energy consumption?

The total energy consumption vs sintering is presented in Fig. 6 (b). The energy consumption decreases from 6.61 MJ to 3.34 MJ (49% decrease in energy consumption) by applying 120 V/cm. The major share of energy is consumed by the furnace and a negligible amount by the applied field.

How is thermal energy distributed in X7R multilayer ceramic capacitors?

Thermal energy distribution of the production of a 1 kg batch of X7R multilayer ceramic capacitors (MLCCs); all production steps requiring thermal energy input are included: drying, calcination, sintering, aging, and electroplating 1

Can LCA be used for environmental profiling of functional ceramics?

Although the LCA technique has been widely used for the evaluation of environmental impacts in numerous product supply chains, its application for environmental profiling of functional ceramics is now gaining attention.

What is the ecological footprint of technical ceramics?

We have discussed the ecological footprint of technical ceramics in recent articles, from their negligible pollutive behaviour to their extended life cycles--a key driver of sustainability. However, ceramic manufacturing is more difficult to reconcile from an environmental perspective given the power-hungry nature of sintering processes.

The effects of sintering conditions and Ni powder size on the dielectric properties of a X7R multilayer ceramic capacitor 479 an increase in the sintering heating rate results in a decrease in the ceramic density, causing the maximum densification temperature to increase which has been explained to be related to xanthan [10].

Specifically, the objectives of the paper are to: (i) carry out a brief review of a number of sintering techniques to highlight and compare their potential towards energy consumption reduction ...

TL;DR: In this paper, the authors identify, quantifies, ranks and compares the environmental impacts of the multilayer ceramic capacitors and TEC supply chains using an integrated hybrid ...

The sintering process is an important part of iron and steel production (Cheng et al., 2016). The gaseous pollutants emitted from this process accounting for 40% of the total emissions from steel production (Zhang et al., 2020c). The sintering flue gas has the characteristics of complex composition, wide temperature range, high oxygen content, and ...

[8] D. Donahoe, "Moisture in Multilayer Ceramic Capacitors," Diss. umd , 2005 [9] C. Voisin, "Influence of Oxygen Substoichiometry on the Dielectric Properties of BaTiO<sub>3</sub>-d Nanoceramics Obtained by Spark Plasma Sintering," International Journal of ...

Ceramic capacitors, such as multilayer ceramic capacitors (MLCCs), are capable of quickly charging and discharging with a high power density[44]. The specifications for X7R MLCCs ...

A typical antiferroelectric P-E loop is shown in Fig. 1. There are many researchers who increase the  $W_{re}$  by increasing DBDS [18, 19], while relatively few studies have increased the  $W_{re}$  by increasing the  $E_{FE-AFE}$ . In pursuit of a simpler method to achieve PLZST-based ceramic with higher  $W_{re}$ , energy storage efficiency and lower sintering temperatures, many ...

Synchrotron X-ray nano computed tomography was used to investigate the microstructural evolution during co-sintering of multi-layer ceramic capacitors (MLCC) consisting of Ni electrodes and BaTiO<sub>3</sub> dielectric layers stacked alternately. As the electrode thickness reduced to submicron at the scale of a few particle diameters, the process produced the defect ...

Semantic Scholar extracted view of "Economics of rare earth elements in ceramic capacitors" by Mohammed A. Alam et al. ... Life cycle assessment and environmental profile evaluations of high volumetric efficiency capacitors. ... Dielectric materials for sintering in reducing atmospheres. D. Hennings. Materials Science, Engineering. 2001; 138. 1 ...

Similarly, the insulation property of electric insulation ceramic coatings is critical for applications in microelectronic circuits and heating elements, superior chemical inertness of corrosion-resistant ceramic coatings is a must-have property in hostile corrosive environments, and high-temperature resistance properties are required for thermal barrier ceramic coatings ...

A wide range of capacitor types, for example, electrolytic capacitors (ECs), super capacitors, and multilayer capacitors are used in modern technologies such as ...

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