

## Electric current activated/assisted sintering (ECAS): a review of patents 1906–2008

Salvatore Grasso *et al* 2009 *Sci. Technol. Adv. Mater.* **10** 053001 (24pp) doi: [10.1088/1468-6996/10/5/053001](https://doi.org/10.1088/1468-6996/10/5/053001) [Help](#)

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**Abstract.** The electric current activated/assisted sintering (ECAS) is an ever growing class of versatile techniques for sintering particulate materials. Despite the tremendous advances over the last two decades in ECASed materials and products there is a lack of comprehensive reviews on ECAS apparatuses and methods. This paper fills the gap by tracing the progress of ECAS technology from 1906 to 2008 and surveys 642 ECAS patents published over more than a century. It is found that the ECAS technology was pioneered by Bloxam (1906 GB Patent No. 9020) who developed the first resistive sintering apparatus. The patents were searched by keywords or by cross-links and were withdrawn from the Japanese Patent Office (342 patents), the United States Patent and Trademark Office (175 patents), the Chinese State Intellectual Property Office of P.R.C. (69 patents) and the World Intellectual Property Organization (12 patents). A subset of 119 (out of 642) ECAS patents on methods and apparatuses was selected and described in detail with respect to their fundamental concepts, physical principles and importance in either present ECAS apparatuses or future ECAS technologies for enhancing efficiency, reliability, repeatability, controllability and productivity. The paper is divided into two parts, the first deals with the basic concepts, features and definitions of *basic ECAS* and the second analyzes the *auxiliary devices/peripherals*. The *basic ECAS* is classified with reference to discharge time (*fast* and *ultrafast ECAS*). The fundamental principles and definitions of ECAS are outlined in accordance with the scientific and patent literature.

**Keywords:** patents, spark plasma sintering, pulsed electric current sintering, electric assisted sintering, electric discharge compaction, field activated/assisted sintering technique

Print publication: Issue 5 (October 2009)

Received 13 June 2009, accepted for publication 2 September 2009

Published 20 November 2009

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