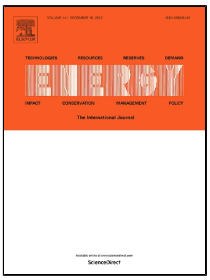
Accepted Manuscript



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PII:	S0360-5442(18)30254-8
DOI:	10.1016/j.energy.2018.02.026
Reference:	EGY 12326
To appear in:	*Energy*
Received Date:	06 September 2017
Revised Date:	05 February 2018
Accepted Date:	08 February 2018

Please cite this article as: D. Miranda, C.M. Costa, A.M. Almeida, S. Lanceros-Méndez, Computer simulation of the influence of thermal conditions on the performance of conventional and unconventional lithium-ion battery geometries, *Energy* (2018), doi: 10.1016/j.energy.2018.02.026

Computer simulation of the influence of thermal conditions on the performance of conventional and unconventional lithium-ion battery geometries

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Abstract:

Thermal analysis is a fundamental issue for the proper evaluation of the performance of lithium ion batteries. Thus, this work reports on the theoretical simulation of the effect of different thermal conditions on the performance of batteries with conventional and non-conventional geometries.

The investigated geometries include conventional geometries (layer by layer), interdigitated, horseshoe, spiral, ring, antenna and gear that can be fabricated by printed technologies for flexible / wearable electronic device applications. The thermal conditions are isothermal, adiabatic and environmental conditions and the computational simulations are based on the electrochemical (Newman/Doyle/Fuller) model.

Generally, the best battery performance is obtained for interdigitated and gear geometries, regardless of thermal conditions. The dissipated ohmic heat is mainly influenced by the maximum distance that the ions move until their intercalation and the thickness of the separator. The present work allows the proper design of the batteries in order to optimize performance for specific applications.

Keywords: lithium-ion batteries; battery geometry; thermal conditions; computer simulations