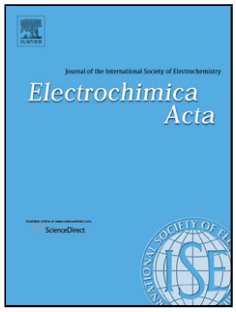

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PII: S0013-4686(16)30292-4
DOI: http://dx.doi.org/doi:10.1016/j.electacta.2016.02.031
Reference: EA 26639

To appear in: *Electrochimica Acta*

Received date: 10-12-2015
Revised date: 4-2-2016
Accepted date: 5-2-2016

Please cite this article as: Enno Kätelh*ddoto*n, Eden E.L. Tanner, Christopher Batchelor-McAuley, Richard G. Compton, Destructive nano-impacts: What information can be extracted from spike shapes?, *<![CDATA[Electrochimica Acta]]>* (2016), http://dx.doi.org/10.1016/j.electacta.2016.02.031

Destructive nano-impacts: What information can be extracted from spike shapes?

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Abstract

The fast-advancing method of nano-impacts is a powerful approach for the immediate detection and characterisation of nanoparticles. During the measurement particles stochastically impact on a biased electrode immersed in a colloidal solution, where they may enable an electrochemical reaction. In the case of a destructive impact, particles electrodissolve at the electrode surface, which can be seen as a spike in the electrode current. While these spikes are successfully used to measure particle concentrations and to determine size distributions via the overall charge transferred per spike, the spike shape is however usually not included in the analysis. In this work, we explore in which ways spike shapes can be exploited to gain additional information on the investigated particle system. To this end, the limiting cases of two reaction models are introduced and discussed in the context of the opportunities and limitations imposed by hardware filters. In particular, we demonstrate that Bessel-type filters conserve the overall charge transferred during an impact event, even if the bandwidth of the signal is far beyond the passband of the filter. Our findings are further compared to experimental data obtained from measurements in aqueous solutions and ionic liquids.

Keywords: Nano-impacts, nanoparticle collisions, nanoelectrochemistry, room temperature ionic liquids, silver nanoparticles

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