Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Charge storage in β-$FeSi_2$ nanoparticle layers AXEL LORKE, JENS THEIS, SEBASTIAN KÜPPER, ROBERT BYWALEZ, HARTMUT WIGGERS, University of Duisburg-Essen — We report on the observation of a surprisingly high specific capacitance of β-$FeSi_2$ nanoparticle layers. Lateral, interdigitated capacitor structures were fabricated on silicon dioxide and covered by $FeSi_2$ particles [1] in the size range 10-30 nm. Compared to the bare electrodes, the nanoparticle-coated samples exhibit a 3-4 orders of magnitude increased capacitance. Time-resolved current-voltage measurements show that for short times (seconds to minutes), the material is capable of storing up to 1 As/g at voltages of around 1 V. The devices are rugged and exhibit long-term stability under ambient conditions. The specific capacitance is the highest for a relative humidity of $\tilde{9}5\%$, while for a relative humidity below 40% the capacitance is almost indistinguishable from the bare electrodes. This strongly suggests that the storage mechanism is not purely geometric and that a - yet unexplored- electrochemical process may be responsible for the observed high specific capacitance. Our findings may also be of technological interest: The devices work without the need of a fluid phase, the charge storing material is earth abundant and cost-effective, and the sample design is easy to fabricate.
(1) Robert Bywalez et al., J. Nanopart. Res. 15, 1878 (2013).

Axel Lorke
University of Duisburg-Essen

Date submitted: 15 Nov 2013 Electronic form version 1.4