

Reference data for Electrical Resistance Tomography

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Abstract

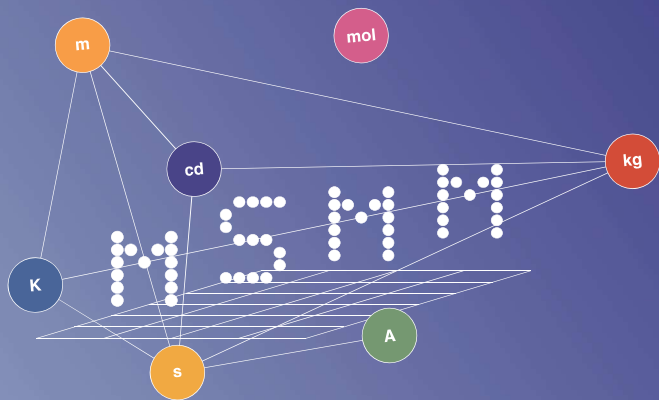
The assessment of the electrical properties of thin-film and nano-structured materials over large area (e.g. like graphene and topological insulators, nano-wire networks, conductive polymers) is of primary importance for the up-scaling of laboratory advances in these fields [1, 2, 3]. Electrical Resistance Tomography (ERT) is a technique that allows for the mapping of the electrical conductivity of thin film materials by performing only boundary electrical measurements [4]. In particular, the ERT boundary measurements consist in a series of four-terminal resistance measurements performed over a number of contacts, following a suitable measurement sequence. The 1D measurements vector, is then used as the input quantity for a suitable solver to retrieve a 2D conductivity distribution array; this calculation represents an ill-posed inverse problem [5].

Many implementations of inverse solvers, some of which of particular interest for ERT in material science, have been proposed [6]. Since ERT represents both a challenge in terms of measurement science and of algorithms development, the availability of open and interchangeable reference datasets would be of great interest for a fruitful exchange among different scientific communities. The last draft

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of the MATHMET’s Strategic Research Agenda¹, sec. 4.2.1, cites ERT as one of the techniques that would take advantage from the availability of such a reference dataset². At the conference we will present a first draft of a machine-readable reference dataset structure for ERT measurements on thin film materials, based on XLM language. Reference data will include ERT measurements, along with a set of meta-data, such as information about the samples (geometry, materials), the measurement protocol used to perform the ERT multiterminal measurements, the measurements uncertainty, instrumentation specifications.

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¹ ”MATHMET Strategic Research Agenda: Supporting the EMN Mathmet by addressing EURAMET’s key priorities and challenges in mathematics and statistics in metrology”

² Deliverable D3 on prioritisation task of the EMPIR project 18NET05 MATHMET.