Karlsruhe Institute of Technology

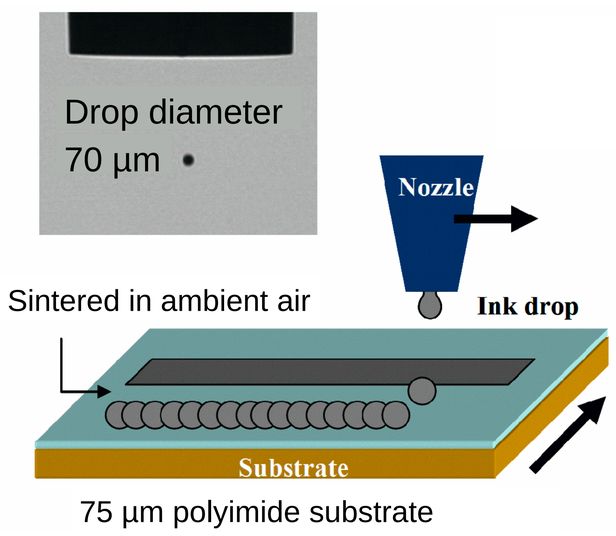
Institute for Applied Materials

Conductivity of stretched printed films

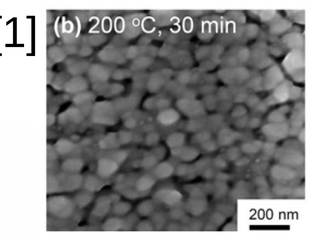
N. Ribic, P. Gruber, M. Kamlah, C. Kirchlechner

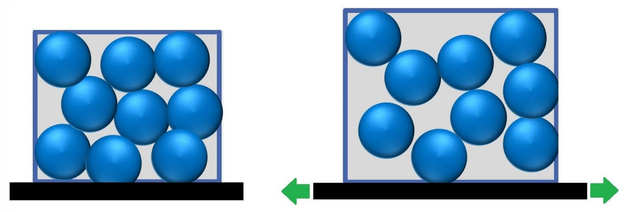
Goal:
Optimize mechanical and electrical properties of printed silver thin films
Method:
Experimental analysis of printed thin films supported by modelling via discrete element and resistor network method

Printing of silver thin films via ink-jet printing

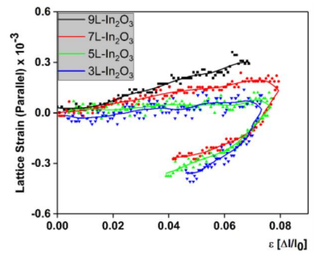


[1]





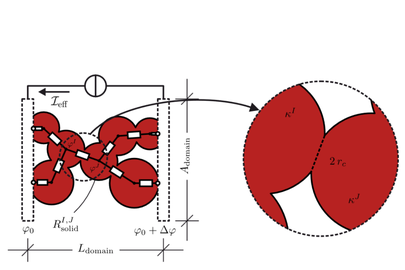
[2]

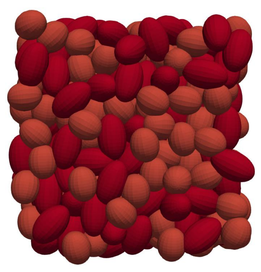


- Silver nanoparticles with diameter of ~50nm printed on flexible substrates in cooperation with Joachim Binder and Tim Mach from IAM-ESS
- Investigating „sand-heap-effect“
- Understand and optimize microstructural parameters for mechanical and electrical performance

Modelling sintered nano - particulate structures via DEM and RN method

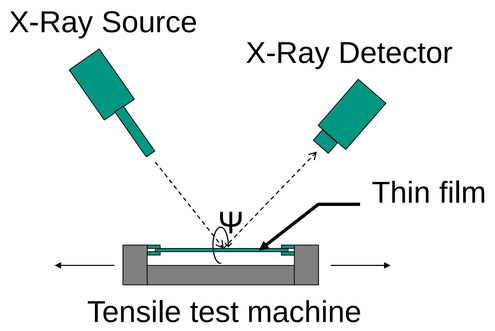
- Adapting institute code to simulate porous thin films under tension
- Implementing gravity and strain load in DEM, RN method to simulate conductivity of microstructure
- Optimize film properties by simulation

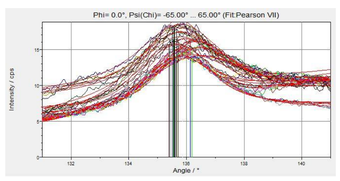


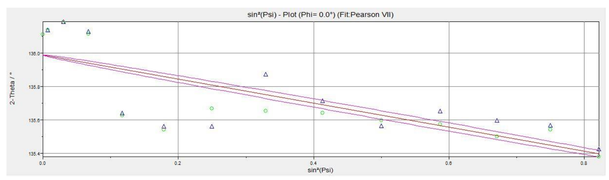


Experimental analysis of thin films via XRD, SEM and Nano-CT

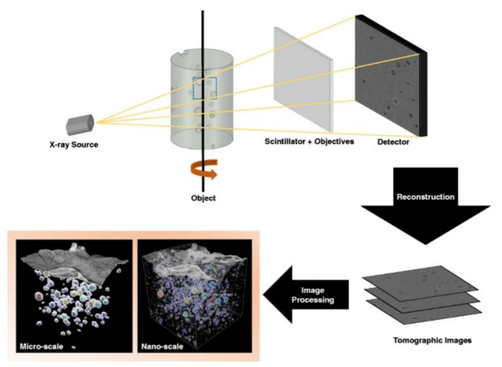
- In-situ stress measurement during tensile testing using XRD
- Used to investigate strain transfer between substrate and thin film







- Nano-CT for 3D projection of thin film sample in cooperation with Konrad Prikoszovich and Raffaela Sebastiani(INT, KNMF)
- Determination of microstructural parameters for simulation setup



[3]

Outlook

- Preparation of different microstructures by varying process parameters and sinter conditions
- Characterization and selection of preferred microstructures
- Adapt model setup based on selected microstructures

E-Mail: niklas.ribic@kit.edu

[1] Kim, Byoung-Joon, et al. "Improving mechanical fatigue resistance by optimizing the nanoporous structure of inkjet-printed Ag electrodes for flexible devices." Nanotechnology 25.12 (2014): 125706
[2] Salarian, Mehrnaz, and Ehsan Toyserkani. "The use of nano-computed tomography (nano-CT) in non-destructive testing of metallic parts made by laser powder-bed fusion additive manufacturing." The International Journal of Advanced Manufacturing Technology 98 (2018): 3147-3153
[3] Mishra, Nilesha. Influence of strain on the functionality of ink-jet printed thin films and devices on flexible substrates. Vol. 77. KIT Scientific Publishing, 2019.