Symposium | A. Advances in Materials Theory for Multiscale Modeling

## [SY-A6]Symposium A-6

Chair: Emma Griffiths(University of Cape Town, South Africa)
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# [SY-A6]Nanoporous Composites: Giving Polymers Strength and Helping Metals Move

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An important benefit of electroactive polymers is their large strain response due to certain stimuli such as an electric current. However, for sufficient mechanical use in electrochemical systems, they lack the necessary strength and stiffness. Metals on the other hand have sufficient strength and stiffness but are unable to function as piezoelectric materials [1]. By creating a metal-polymer composite, however, a stronger material with large strain capacity is created that can withstand larger actuation forces. Specifically, using polymer impregnated nanoporous structures, with their exceptional mechanical properties providing a reinforcing base [2,3], creates a composite material with superior actuator properties by having both sufficient strength and strain capabilities.

This work presents the chemoelectromechanical response of a gold-polymer nanocomposite model. A representative volume element is modelled using a linear version of the chemoelectromechanical theory developed by Wilmers et al. [4] and is implemented through a staggered explicit-implicit finite element simulation in ABAQUS. Additionally the theory is enhanced by introducing an implicit solvent model to capture the effects of the crowding of ions due to saturation within the material. The micromechanical response of the composite is explored under an imposed electric field and thus providing information to be used in the optimization of microstructures for sensory and actuation applications.

References

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