

7<sup>th</sup> Annual Congress on

# Materials Research and Technology

February 20-21, 2017    Berlin, Germany



## Said Mansour

*Hamad Bin Khalifa University, Qatar*

### Correlative and in-situ materials characterization

**M**aterials characterization is one main pillar of materials development that plays critical role in the advancement of materials research and discovery of new innovative materials. It enables characterization and measurements of structure-property (chemical, mechanical, thermal, dielectric and electrical) and structure-process relationships covering wide ranges with high sensitivities and high spatial and temporal resolutions of compositions (from PPb to percentages), lengths (from atoms to millimeters) and time (from nanoseconds to hours). Moreover, the rapid use of nanoscale materials in different materials research disciplines compounded demand by the materials research community for understanding rapidly changing nanoscale properties and consequent characterization. Therefore, development and availability of user friendly characterization instrumentation and techniques with high resolution power, high sensitivity and speed and with automated, accurate, and repeatable measurements became crucially important to understand the synthesis and behavior of innovative multidimensional materials. Furthermore, a need for real time studies of reactions, phase changes, heating and cooling effects, stress and fracture measurements emerged strongly. Consequently, characterization techniques made big strides in last 2-decades. Thanks to joint effort by scientific community researchers and equipment manufacturers. High spatial resolution powers down to 0.5 Å, low detection limits in the ppb ranges and multimodal measurements were realized and amble in-situ applications and techniques were developed. Such developments enabled new research frontiers in dynamic studies of heterogeneous catalysts, environmentally sensitive battery materials for energy storage and made thin films deposition in-situ measurements (thickness, dielectric properties,  $n$  and  $k$ ) a possibility. The Qatar Environment and Energy Research Institute (QEERI) at Hamad Bin Khalifa University (HBKU); a nascent Institute, just completed the build of an Advanced Materials Characterization facility in support of the research and education mission of the university and the institute. The state-of-the-art facility comprises of an advanced microscopy and microanalysis, surface science and x-ray diffraction centers, thermal analysis lab, molecular spectroscopy and NMR labs. The facility provides many in-situ capabilities in support of QEERI's research portfolios in solar PV, Li-ion, Na-ion and Na-S batteries for energy storage, heterogenous catalysis and membranes for water desalination. Examples are heating, cooling and liquid cell TEM stages, XPS environmental chambers with glove box, cryo-TEM and cryo-SEM stages, built in SEM x-sectioning stage and others. In house correlative capabilities provide effective means for faster diagnosis of failures root cause analysis of devices as well improved understanding of devices performance and reliability. The presentation will share the extent of capabilities and the vision to take full advantage of the sophisticated techniques in support of energy and water security grand challenges research in Qatar and the region.

[smansour@hbku.edu.qa](mailto:smansour@hbku.edu.qa)

### Notes: