

# JOINT SEMINAR

Mat•Al: Team Building through Scientific Communication  
Texas Center for Superconductivity at the Univ. of Houston

## Dr. Robson S. Monteiro

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**Monday, May 5, 2025**

11:00 a.m. – 12:00 p.m.  
Houston Science Center (HSC), 102

### Industrial insights on the usage of niobium oxides for doping and coating of cathode active materials



**ABSTRACT:** Niobium oxides ( $\text{Nb}_2\text{O}_5$ ) are experiencing significant usage growth for doping and coating of cathode active materials in Asia producing countries. As more advanced chemistries and better industrial grades of spinel (LMO), olivine (LMFP/LFP) and layered oxides (mid- and high-Ni NMCA) cathodes are making their way into the marketplace, niobium oxides have been increasingly used to improve their electrochemical performance and structural stability. Observed benefits of niobium oxides as doping or coating compounds on different cathode chemistries are higher electronic and ionic conductivity, rate capability

enhancement, first-cycle loss decrease, high-voltage H2-H3 phase transition stress mitigation, and thermal and cycling stability. Key to success is the careful choice of the appropriate customized niobium oxide precursor material available on a large industrial scale alongside the optimization of synthesis parameters to ensure effective niobium incorporation. Particle size distribution and crystal structure orientation of niobium oxide particles are custom parameters which affect the particle reactivity for doping. Lithium niobates ( $\text{LiNbO}_3/\text{Li}_3\text{NbO}_4$ ) are formed by the reaction of niobium oxide particles with residual lithium on the surface creating a coating with superior ionic conductivity and less reactive protective properties against cathode surface degradation. Simultaneous doping and coating can be realized on polycrystalline cathodes upon the fine-tuning of the lithiation temperature. This contribution will highlight the niobium oxides attributes from an industrial perspective shedding light to the importance of doping and coating compounds to the improved performance and successful commercialization of the next generation of cathode active materials of lithium-ion battery technology.

**BIO:** Dr. Robson S. Monteiro is the Global Market Development Senior Manager for CBMM North America Inc., a Brazilian-based mining and metallurgical company and the world's largest supplier of niobium products. He is a Chemical Engineer with a Ph.D. degree from COPPE-Federal University of Rio Janeiro (Brazil) and post-doctoral fellowship at WPI, where he made contributions to the field of catalytic combustion for power generation and nanostructured carbon materials. He is an internationally minded and savvy market development professional with 20+ years of experience in R&D and market commercialization of niobium oxides for energy storage and conversion materials, industrial catalysts, optical and ceramic nanomaterials. Dr. Monteiro is a Senior Member of the American Institute of Chemical Engineers (AIChE) and American Chemical Society (ACS). He has published more than 30 peer-reviewed articles in scientific journals, holds several patents and is a public speaker giving lectures at international conferences and teaching courses in academic institutions around the world.