THE UNIVERSITY OF HONG KONG

DEPARTMENT OF MECHANICAL ENGINEERING

SEMINAR

Online

Title: **Vanadium dioxide: from physics to applications**

Speaker: **Prof. Junqiao Wu**
Professor
Department of Materials Science and Engineering
University of California, Berkeley
USA

Date: **6 May 2021 (Thursday)**

Time: **10:00am – 11:00am**

Zoom Meeting: 1) Link to join the meeting:
https://hku.zoom.us/j/91352608904?pwd=T2p6R0lUWW9nUkxqRS9lVnBsK255QT09

2) Meeting ID: 913 5260 8904
3) Password: 958003

Abstract:

As a textbook example of strongly correlated electron materials, vanadium dioxide features a metal-insulator phase transition accompanied by a structural transition at 67^{o}C. The physics of the electron correlation and the transition has challenged researchers for decades, while fascinating device applications have been proposed or realized based on this material. In this talk, I will highlight our recent discoveries in the study of vanadium dioxide and related materials. (i) We discovered a new electron conduction mode in the metallic phase of vanadium dioxide, in which the Wiedemann-Franz law was found to be broken, and itinerant electrons were shown to conduct charge but (almost) not heat. The work revealed a totally new, but very likely general, behavior of electron dynamics in a strongly correlated electron fluid where heat and charge diffuse independently. (ii) Using these materials, we developed new technologies for smart thermal radiation regulation. A thermal imaging sensitizer (TIS) boosts the sensitivity of uncooled thermal infrared imaging from the previous 0.04 K to 0.003 K at room temperature, leading to unprecedented products for early detection of subcutaneous tumors and inspection of hidden building defects. A temperature-adaptive radiative coating (TARC) was also invented that adapts its thermal emittance to different ambient temperatures. The TARC automatically switches thermal emittance from 0.20 for ambient temperatures lower than 15 °C to 0.90 for temperatures above 30 °C. The TARC is simulated to outperform all existing roof coatings for energy saving in most climates, especially those with significant seasonal variations.

Biography:

Professor Junqiao Wu received a B.S. from Fudan University and a M.S. from Peking University, China, both in physics. He obtained a PhD degree from the University of California, Berkeley in applied physics for work on nitride semiconductors and semiconductor alloys. He did postdoctoral research in the Department of Chemistry and Chemical Biology at Harvard University. He began his faculty appointment in the Department of Materials Science and Engineering at the University of California, Berkeley in 2006. His honors include the Berkeley Fellowship, the 29th Ross N. Tucker Memorial Award, the Berkeley Presidential Chair Fellowship, the US-NSF Career Award, the US-DOE Early Career Award, the Presidential Early Career Award for Scientists and Engineers (PECASE) from the White House, the Outstanding Alumni Award from Peking University China, the Bakar Faculty Fellows Award, the Bakar Prize, and elected Fellow from the American Physical Society (APS). He is currently the Chair of the Applied Science and Technology Graduate Group (the largest interdisciplinary research group at UC Berkeley), and holds a joint appointment at the Lawrence Berkeley National Laboratory. The Wu group explores novel properties and applications of electronic materials with reduced dimensions, phase transitions at the nanoscale, and optoelectronic, thermal and thermoelectric properties of semiconductor alloys and interfaces. Prof. Wu has published over 200 widely cited papers in the fields. For more details, please visit https://wu.mse.berkeley.edu/

ALL INTERESTED ARE WELCOME

For further information, please contact Prof. Y.C. Leung at 3917 7911.