Department of Materials Science and Engineering Seminar Series 2024

3D-PRINTED FUNCTIONAL MATERIALS AS ELECTRODES FOR WATER SPLITTING

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Date and time: 28th Oct at 3pm

Venue: EA-06-03

Abstract

Additive manufacturing (also known as 3D printing) has demonstrated its great potential in the customized structural design of complex geometry and as a facile method for electrode and electrochemical cell fabrication. Given the recent development of several fast-prototyping materials and printing methods, exploring the feasibility of scaling up electrode production by 3D printing is important. This thesis examines the potential of large-scale production of electrodes fabricated by two 3D printing techniques - direct ink writing (DIW) and digital light processing (DLP). The 3D-printed electrodes show superior catalytic performance for electrochemical water splitting under high current density (≥ 500 mA cm-2). The materials' printability and post-printing heat treatment procedures (including de-binding, decomposition, sintering, and reduction) are investigated. In addition, the electrochemical catalytic performance testing is conducted under both typical lab-scale (10 – 100 mA cm-2) and industry-scale (500 – 1500 mA cm-2) current densities. Furthermore, density functional theory (DFT) calculations are conducted for the third work in this thesis, which is to provide theoretical evidence for the catalytic mechanism of the chosen material system. Overall, this thesis provides possible solutions for large-scale green hydrogen production by 3D printing – adopting DIW and DLP as fabrication methods to achieve facile and massive electrode production for electrochemical water splitting.

Biography

Xun Yanran received her B.Sci degree from Shandong University, China. She is currently a Ph.D candidate under the supervision of Prof. Ding Jun. Her research focuses on additive manufacturing (particularly in DLP and DIW) and their application in electrochemical water splitting.

Please join us!

HOST: Dr Zhao Ming