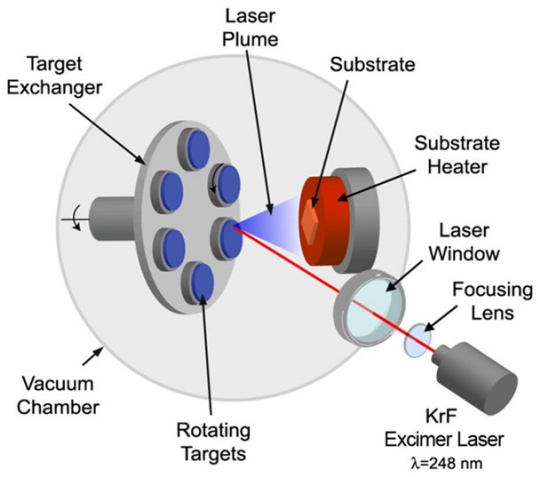
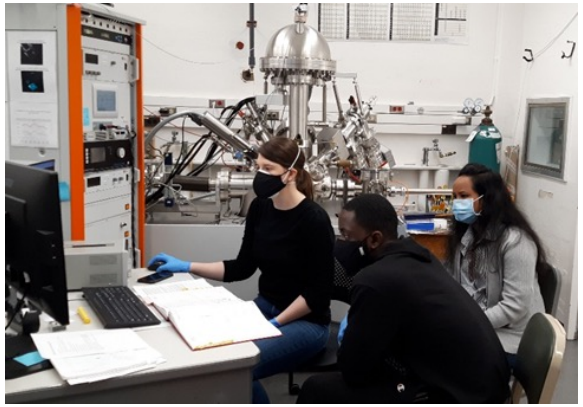
DMR-2122067 PREM

Effect of Substrate-Induced Lattice Strain on the Electrochemical Properties of Pulsed Laser Deposited (PLD) Nickel Oxide Thin Film

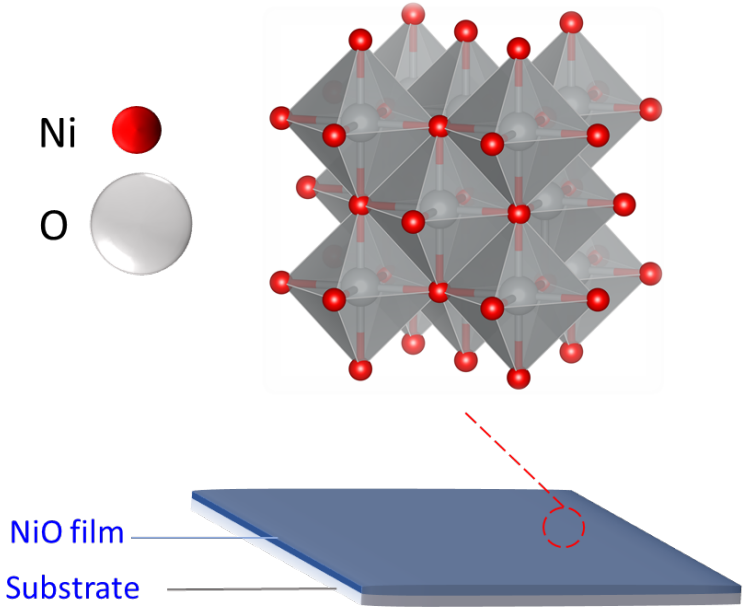
Collaborative Research and Education in Energy Materials (CREEM)



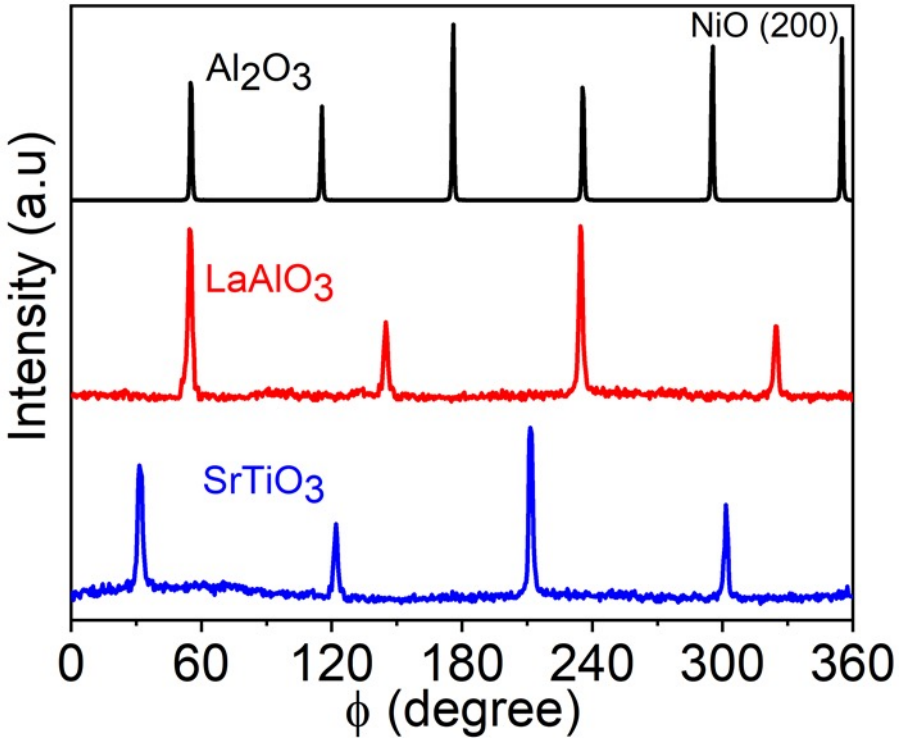
Schematic of a PLD Process



NCAT-PREM students (Jacob Som and Manosi Roy) working in the XPS lab of the Cornell Center for Materials Research (CCMR)



- NiO is a p-type oxide semiconductor with excellent electrochemical Performance
- Effect of lattice strain in the NiO thin films on the hydrogen evolution reaction overpotential have been studied



Epitaxial nature of the NiO films on three substrates was confirmed by the phi scan of Ni (200) peak

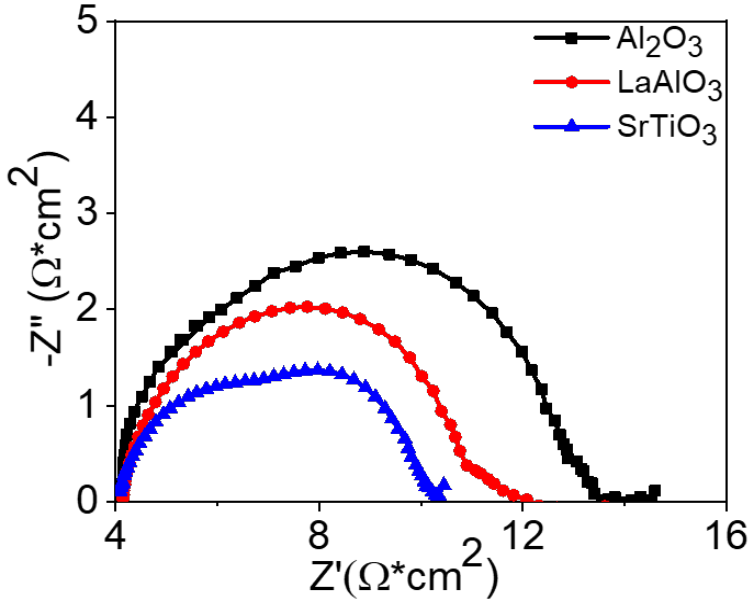
Jacob Som, J. Choi, H. Zhang, N.R. Mucha, S. Fialkova, K. Mensah-Darkwa, J. Suntivich, R.K. Gupta, D. Kumar, "Effect of substrate-induced lattice strain on the electrochemical properties of pulsed laser deposited nickel oxide thin film, Materials Science and Engineering B, Volume 280, June 2022, 115711, https://doi.org/10.1016/j.mseb.2022.115711

NSF DMR DIVISION OF MATERIALS RESEARCH
DIRECTORATE FOR MATHEMATICAL AND PHYSICAL SCIENCES

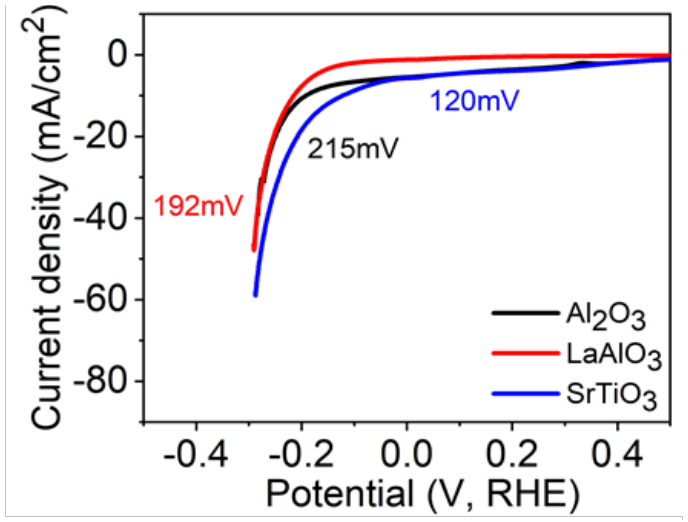
DMR-2122067 PREM

Effect of Substrate-Induced Lattice Strain on the Electrochemical Properties of Pulsed Laser Deposited Nickel Oxide Thin Film

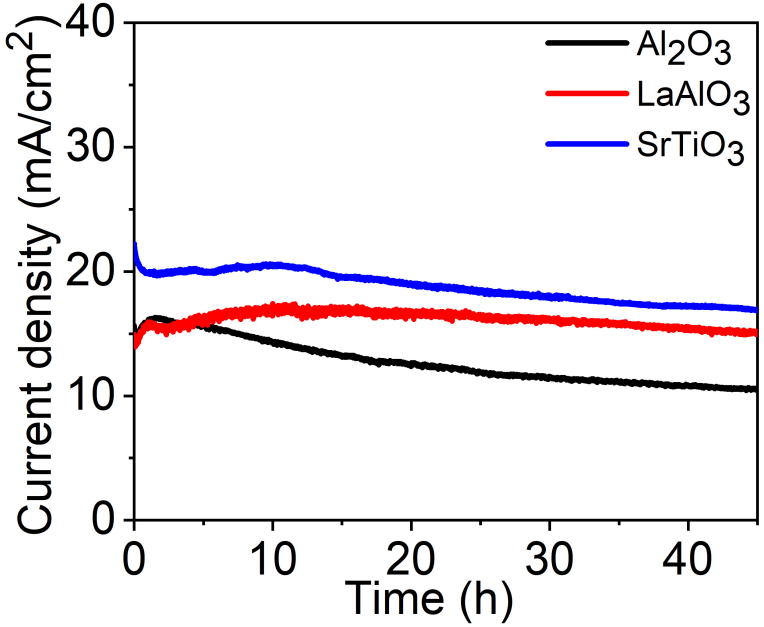
Collaborative Research and Education in Energy Materials (CREEM)



- Radii of semicircular Nyquist plots represent the charge transfer resistance between the electrode interface and the electrolyte.
- Nyquist plots show that SrTiO3/NiO sample has the fastest reaction kinetic rate among the other samples in this study.



Polarization curves of the NiO films



Time-dependent current density plots for NiO films show their high electrochemical stability.

Summary: The interaction between the film and the substrate plays important roles in modulating the microenvironment and consequently improving the activity and durability of thin film electrocatalyst.

DMR DIVISION OF MATERIALS RESEARCH
DIRECTORATE FOR MATHEMATICAL AND PHYSICAL SCIENCES

Som J, Choi J, Fialkova, Gupta R, Kumar D. “Effect of Substrate-Induced Lattice Strain on the Electrochemical Properties of Pulsed Laser Deposited Nickel Oxide Thin Film,” Bulletin of the American Physical Society. 2022 Mar 18. 10:24 AM -10:36 AM, Session Y10