

Optimizing Mechanical Properties in Diamond-like Carbon Coatings for Industrial Applications

Sachin V. Muley¹, Aiping Zeng², Patrick Heaney², Paul M. Voyles^{1*}

¹Department of Materials Science & Engineering, University of Wisconsin-Madison

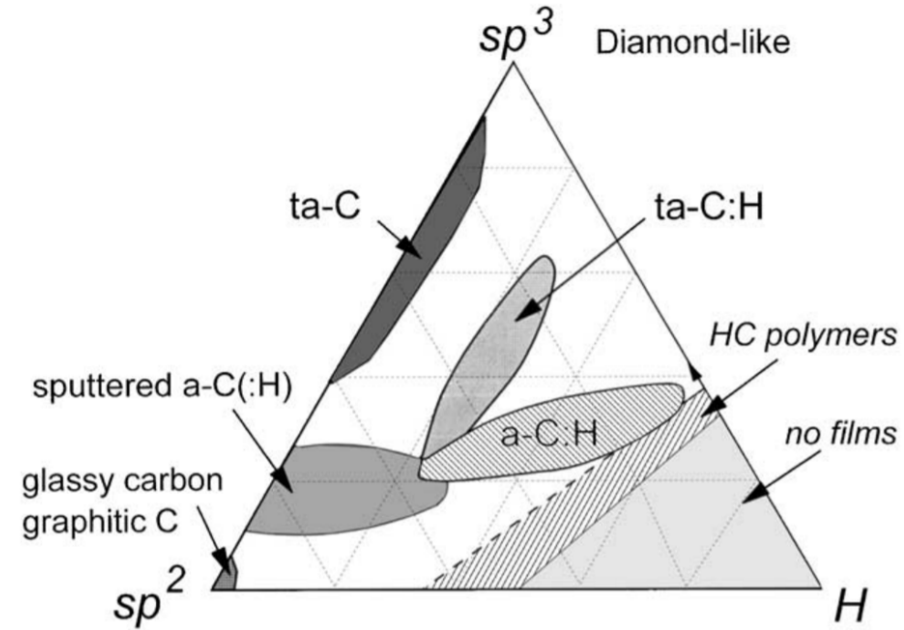
²NCD Technologies, Madison

Facilities Day Open House

May 21, 2019



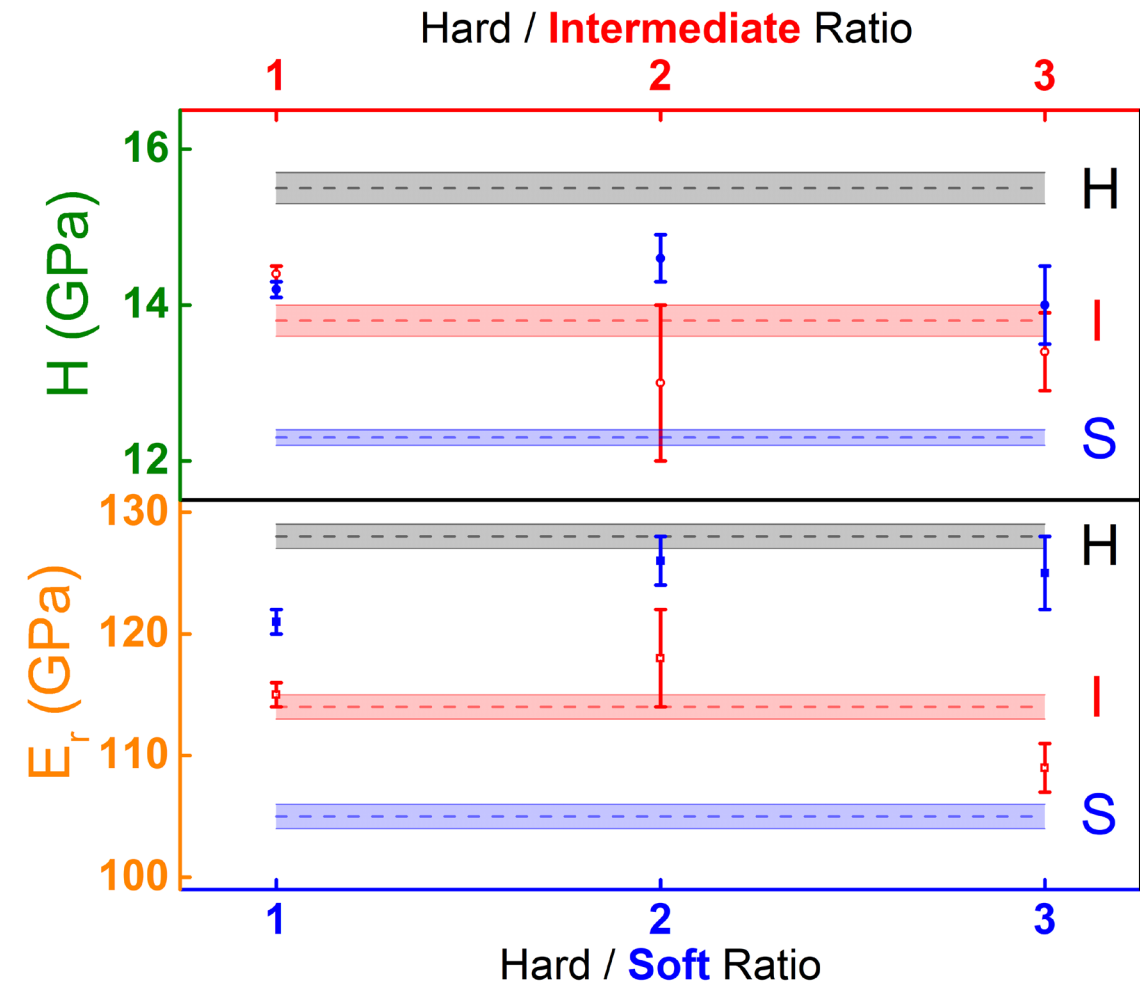
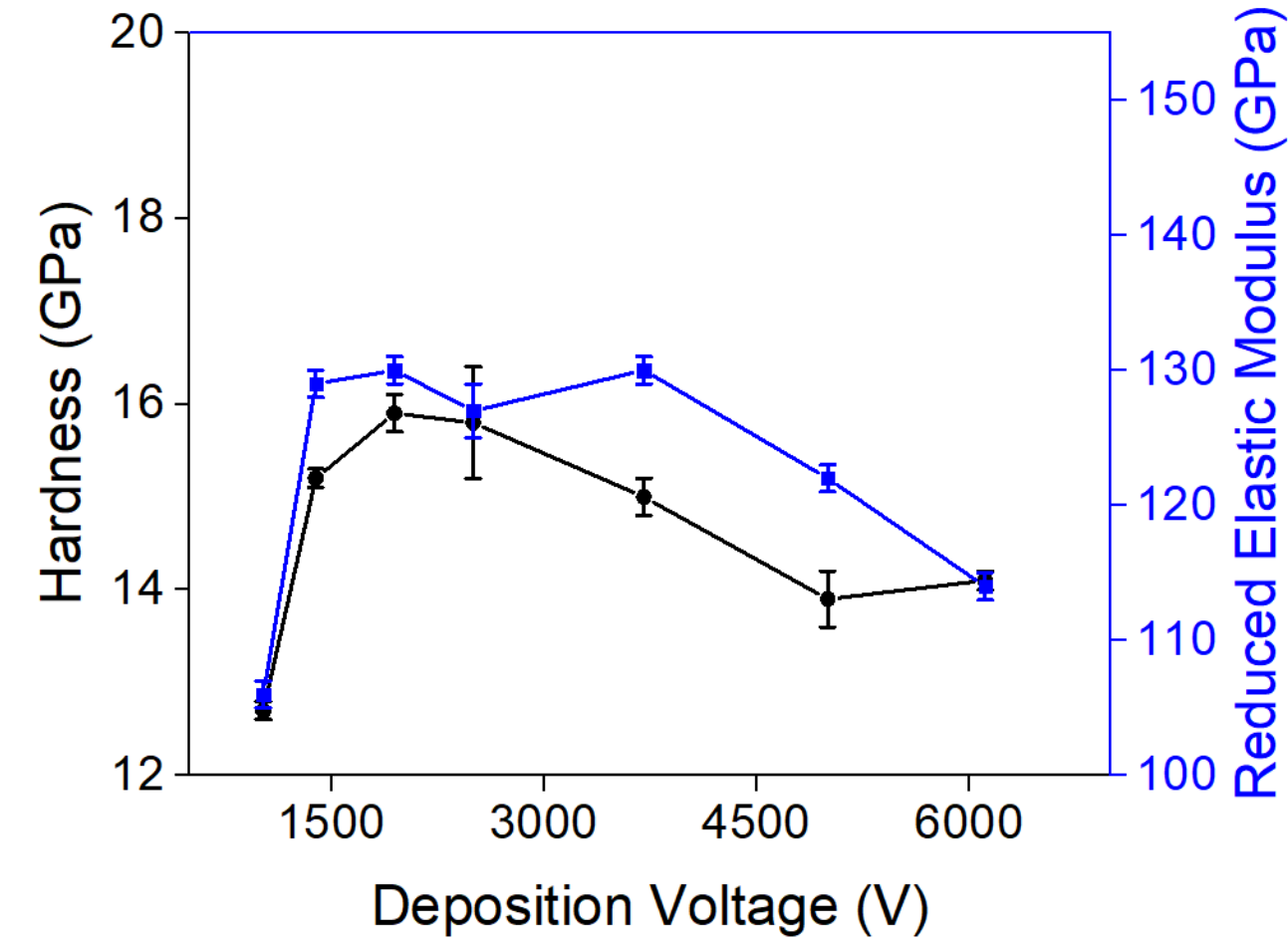
Introduction: Diamond-like Carbon (DLC) Coatings



J Robertson. Mater Sci Eng R Rep 37 (2002) 129 – 281

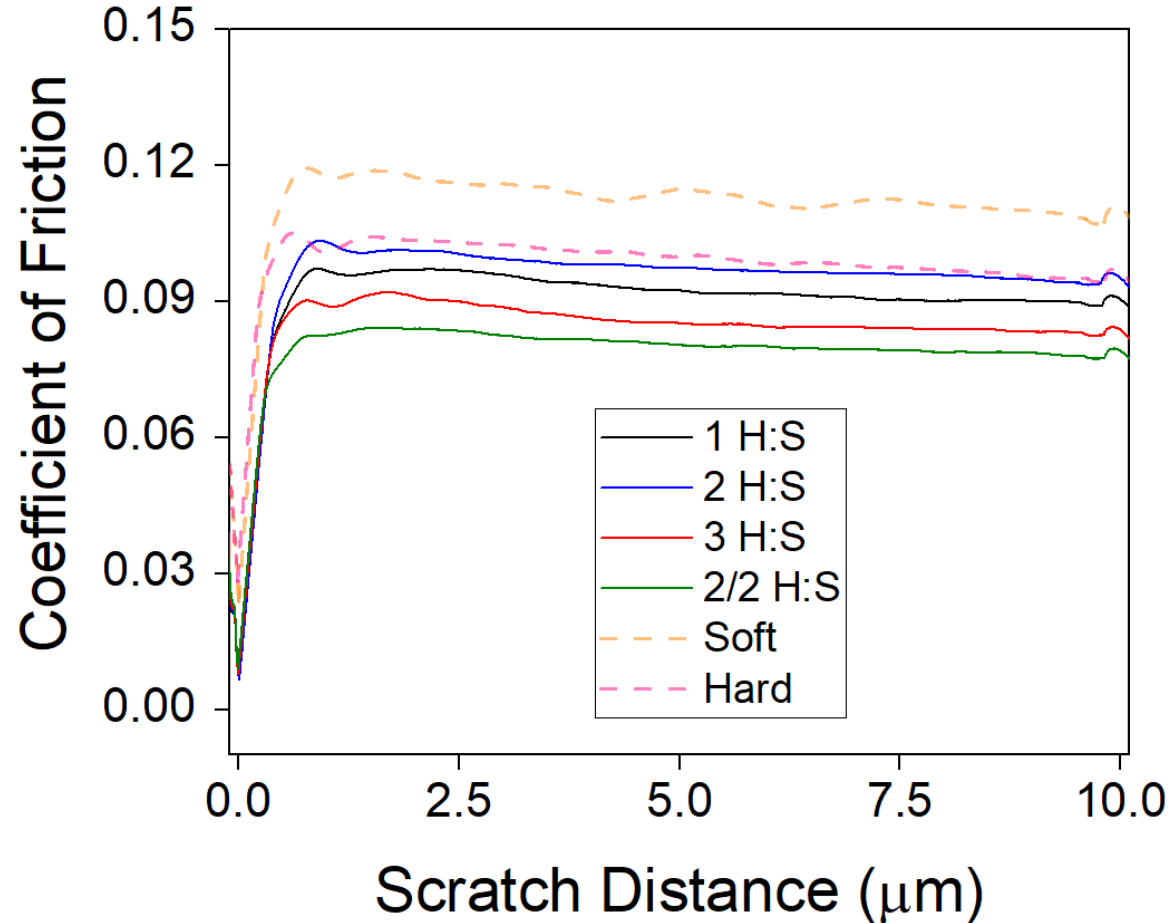
- Low CoF, high E & H, excellent wear resistance and adhesion – applications in cutting tools, magnetic discs, implantable medical devices, etc. require combination of properties
- Thin film structure and properties controlled by deposition conditions – deposition voltage, pulse width and duty cycle
- **Goal:** systematically understand processing-structure-mechanical property correlations in DLC coatings manufactured by NCD Technologies

Probing DLC Thin Films via Nanoindentation



- Deposition parameters optimized in single-layered films for high hardness using nanoindentation – deposition voltage found to be strongest controlling parameter
- Multi-layered thin films expected to show improved friction and wear behavior – multi-layer recipes developed and tested by nanoindentation to establish mechanical properties' limits

Probing DLC Thin Films via Scratching



- Multi-layered films have better friction behavior, possibly due to less compressive stress
- In-situ SPM – surface scans of scratches provides additional insights
- Ongoing – wear testing to test wear resistance

