

Multimodal Predictions of Friction Evolution in Nanostructured Metallic Films

Scientific Achievement

In this work, an encoder-decoder algorithm learned to predict friction response of metallurgical thin films. This can be used to infer the strength of causal relationships.

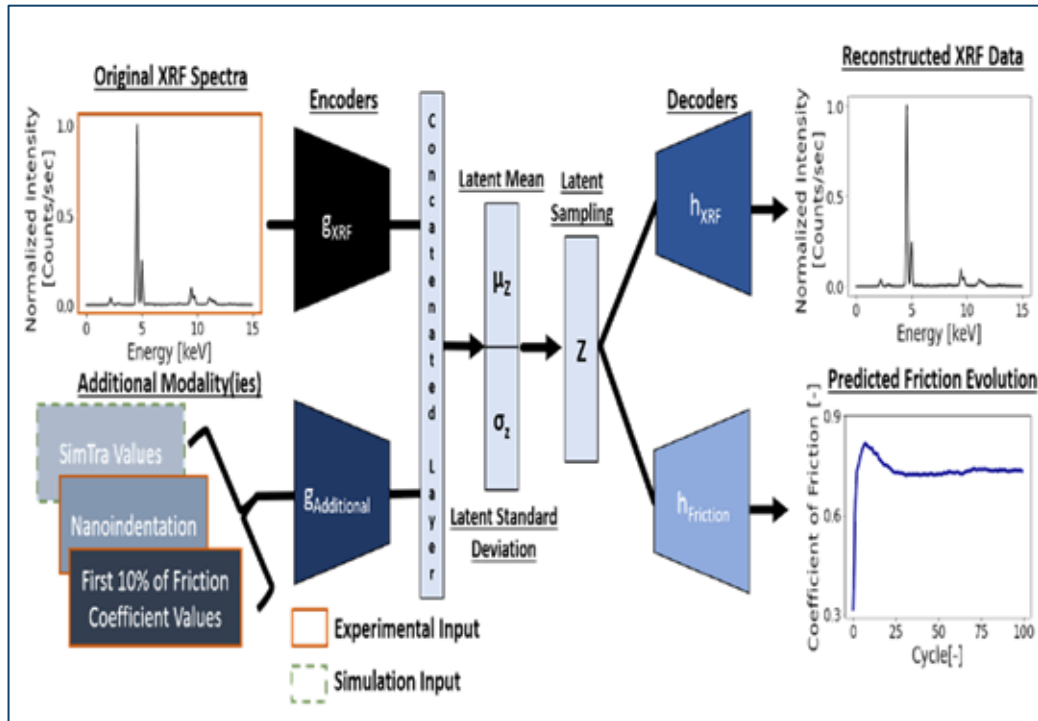


Figure: An Encoder-Decoder architecture learns to predict cycle-dependent evolution of tribological friction of nanocrystalline thin films based on X-ray Fluorescence spectra, Simulations of film deposition, Nanoindentation Hardness & Modulus, and in some cases the initial friction response.

Significance and Impact

Advanced algorithms can regress relationships between material processing, structure, and properties. A CINT User Team learned that friction prediction was less sensitive to nanoindentation hardness than it was to X-ray spectra.

Research Details

- High-throughput multimodal data was fused to predict “friction traces” (friction coefficient changes with cyclic sliding contact) from four inputs.
- Two distinct encoder-decoder architectures were employed to compare their abilities to regress this multimodal dataset.

Brown, N. K.; Morgan, A.; Lee, K.; DelRio, F. W.; Custer, J.; Adams, D. P.; Babuska, T. F.; Curry, J. F.; Boyce, B. L. Multi-Modal Predictions of Material Degradation: A Case Study on Friction Evolution. *Materials Today*. 2026.

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