

Supplemental material “Electronic Correlations in Epitaxial CrN Thin film”

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X-ray photoelectron spectroscopy measurements-

The nitrogen stoichiometry in CrN is known to influence its properties. To check the correct chemical states and stoichiometry along with XAS, Cr-2P and N-1s core level has been probed using the x-ray photoemission spectroscopy (XPS) measurements. The XPS measurement has been performed on the CrN thin film deposited at $R_{N2}=30\%$ using a Al K_{α} (1486.6 eV) x-ray source with the instrumental resolution ≈ 0.8 eV. Fig. S3 (a) and (b) shows the Cr-2p and N1s core-level spectrum, respectively. Here, the low binding energy (BE) metallic screening feature (pre-edge feature) is not resolved [1]. The fitted XPS spectra has been shown in fig. S4. From the fitted XPS data we observed the well-screened features (A, C) at the lower BE side of the main spin-orbit splitted (Cr-2p_{3/2} & 2p_{1/2}) features (B, D). These spectra are deconvoluted using the combination of the Gaussian and Lorentzian and the binding energy position agrees with the earlier reports again confirming the +3 charge state of Cr. The N-1s spectrum is well-fitted using a single peak confirming the correct chemical order [1,2].

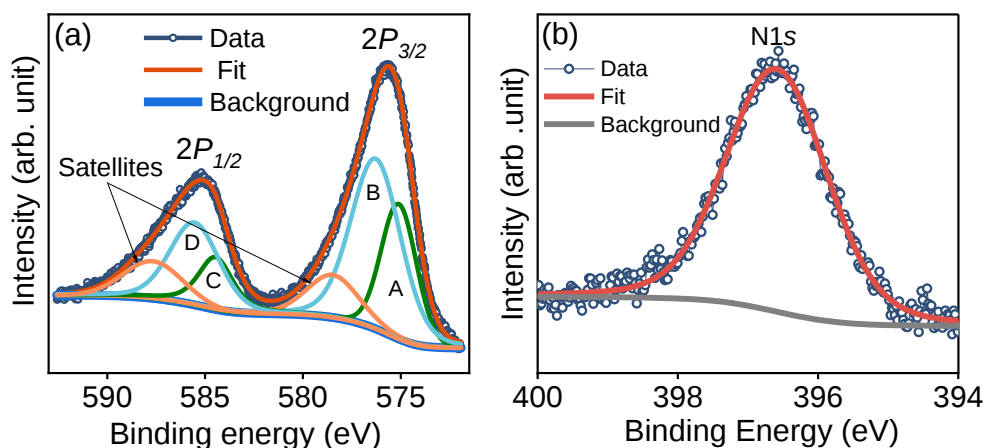


Fig S1. (a) Cr 2p and (b) N 1s core level x-ray photoemission spectrum of the CrN thin film deposited at $R_{N2} = 30\%$

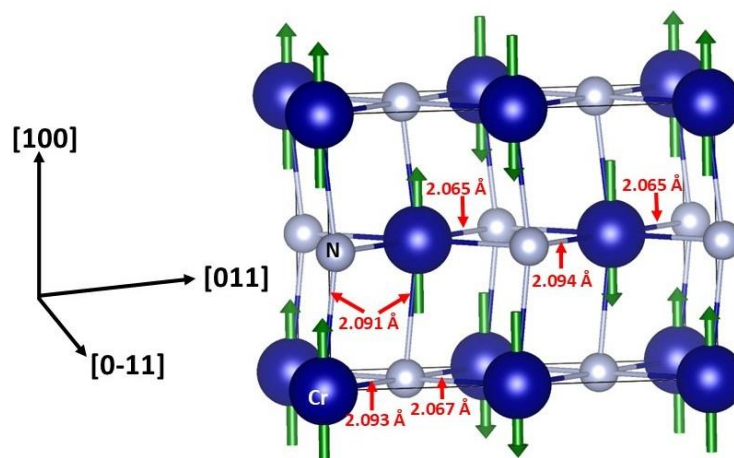


Fig. S2. DFT estimated orthorhombic cell of CrN with AFM $[110]_2$ spin ordering.

References:

- [1]. P. Bhowe, A. Chainani, M. Taguchi, T. Takeuchi, R. Eguchi, M. Matsunami, K. Ishizaka, Y. Takata, M. Oura, Y. Senba, H. Ohashi, Y. Nishino, M. Yabashi, K. Tamasaku, T. Ishikawa, K. Takenaka, H. Takagi, and S. Shin, Evidence for a correlated insulator to antiferromagnetic metal transition in CrN, *Physical review letters* **104**, 236404 (2010).
- [2]. Z. Hui, X. Tang, R. Wei, L. Hu, J. Yang, H. Luo, J. Dai, W. Song, X. Liu, X. Zhu, Y. Sun, Facile chemical solution deposition of nanocrystalline CrN thin films with low magnetoresistance, *RSC Advances*. 4 (2014) 12568–12571.