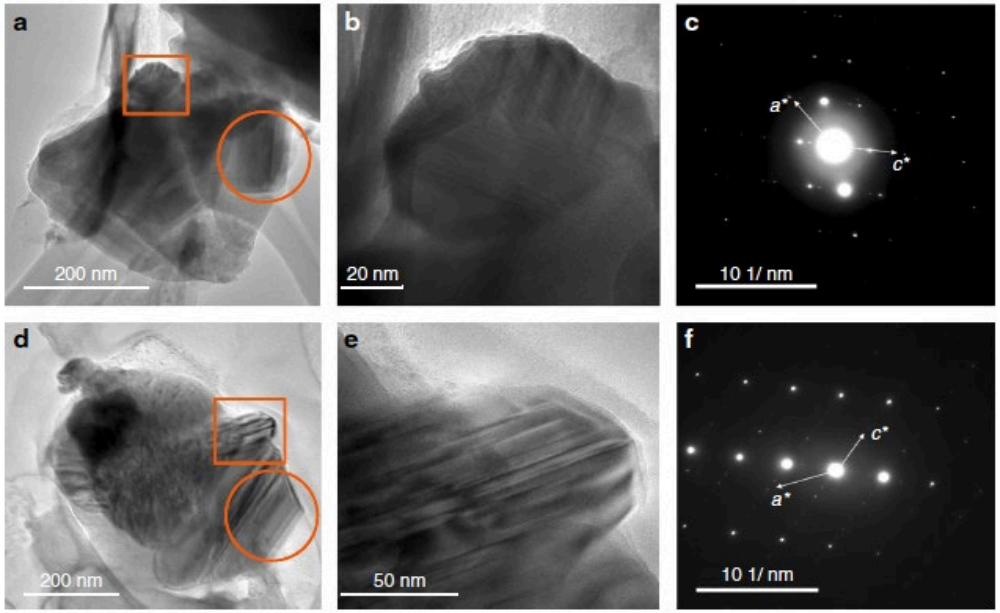
Discovery of a new pathogen from coal burning

Burning coal produces more global warming CO_2 relative to all other fossil fuels. In addition, dealing with the downsides of burning coal on massive, protracted scales includes severe human health impacts. The most important short-term consequence is that coal-burning is a major contributor to atmospheric particulate matter with aerodynamic diameter smaller than 2.5 μm (so-called PM2.5), We have discovered that burning coal produces large quantities of otherwise rare Magnéli phases (Ti_xO_{2x-1} with $4 \le x \le 9$) which are derived from TiO_2 minerals naturally present in coal. This provides a new tracer for tracking solid-state emissions worldwide from industrial coal-burning. In its first toxicity testing in zebrafish and mice, we have also shown that nanoscale Magnéli phases, likely, have toxicity pathways human lungs. In the future, these phases should be thoroughly tested for their toxicity in humans. This work was reported in many dozens of new outlets internationally.



TEM image of a Magnéli phase (Ti_xO_{2x-1}) in a typical coal ash. (b) A magnified TEM image of the square selected area in a. (c) Selected area electron diffraction (SAED) pattern of the circular selected area in a. (d) TEM image of Ti_xO_{2x-1} in another coal ash. (e) A magnified TEM image of the square selected area in e. (f) SAED pattern of the circular area in d.

Yang Y., Chen B., Hower J., Schindler M., Winkler C., Brandt J., Di Giulio R., Liu M., Fu Y., Zhang L., Priya S., Hochella M.F. Jr. (2017). Discovery and ramifications of incidental Magnéli phase generation and release from industrial coal burning. Nature Communications. Additional paper in preparation for PNAS on mice exposure studies. Authors from East China Univ., U. Kentucky, Laurentian U. (Canada), Duke U., and Virginia Tech. Work performed at NanoEarth.

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