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**Chemical Reaction in a Single Crystal: Monitoring Structural Changes in a Multi-Step Oxidation Process by Single Crystal X-Ray Crystallography.** Xiaoping Wang<sup>1,2</sup>, Qinliang Zhao<sup>2</sup>, Rongmin Yu<sup>2</sup>, Carlos A. Murillo<sup>2</sup> and F. Albert Cotton<sup>2</sup>, Dept. of Chemistry, Univ. of North Texas, Denton, TX 76203; <sup>2</sup>Laboratory for Molecular Structure and Bonding, Texas A&M Univ., PO Box 30012, College Station, TX 77842.

An unusual case of multi-step single-crystal to single-crystal (SCSC) conversions via chemical oxidation has been observed for the dimolybdenum molecular pair  $\text{Mo}_2(\text{DAniF})_3(\mu\text{-OD})_2\text{Mo}_2(\text{DAniF})_3$ , where DAniF is the anion of *N, N'*-di-*p*-anisylformamidinate. It reacts readily with atmospheric oxygen and undergoes two successive SCSC oxidative conversions in about three weeks. First to form a mixed-valence compound,  $\text{Mo}_2(\text{DAniF})_3(\mu\text{-O})(\mu\text{-OD})\text{Mo}_2(\text{DAniF})_3$ , which is inaccessible by a solution reaction, and then to a doubly oxidized product,  $\text{Mo}_2(\text{DAniF})_3(\mu\text{-O})_2\text{Mo}_2(\text{DAniF})_3$ . “Snapshots” of the structural changes were obtained from single-crystal structures solved during the oxidation process.