Supplemental

Effect of Surface Cleaning Efficacy on Vapor-phase Surface Cleaning of Cu and Co for Area-Selective Atomic Layer Deposition Using Anhydrous N_2H_4

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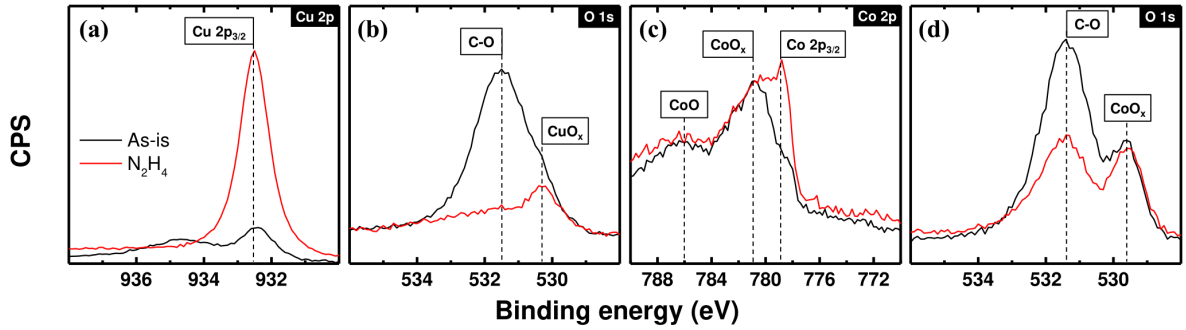

Figure 1. *Ex-situ* XPS spectra of Cu[3] and Co samples before (black) and after (red) N_2H_4 exposure at 200 °C, 300 mTorr. (a) Cu 2p, (b) O 1s of Cu, (c) Co 2p, and (d) O 1s of Co. Both Cu and Co XPS result demonstrates the reduction capability of N_2H_4. Reduction of both carbon oxide and metal oxide bond can be observed in O 1s scan of both Cu and Co. The *ex-situ* condition makes the surface re-oxidize while sample transfer as shown in O 1s scan in both cases.

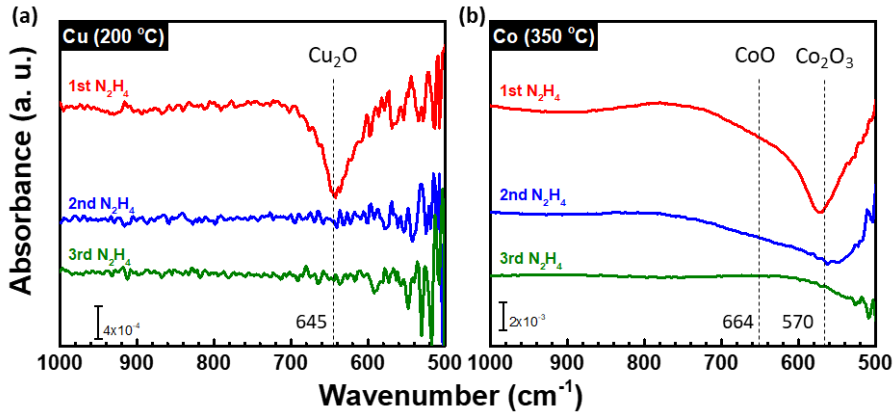

Figure 2. Differential IR spectrum of (a) Cu and (b) Co samples treated using N_2H_4 at 200 °C and 350 °C, respectively. In the case of Cu, surface is oxidized to Cu_2O under the exposure of air and the Cu_2O is reduced to metallic Cu with N_2H_4 treatment and 200 °C. On the other hand, Co surface is formed with Co_2O_3 and CoO and the reduction of the oxides requires higher temperature (350 °C) due to the relatively stability of CoO_x.

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[3] S.M. Hwang, et al., ECS Trans. **92**, 265 (2019).