Silane Oxidation Catalyzed by Carbon Nanotube–Gold Nanohybrids

Results:

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\begin{align*}
R'_1Si(R'_2)_{2}H + nH_2O & \xrightarrow{\text{AuCNTs (0.1 mol%), air, THF, r.t., time}} R'_1Si(R'_2)OH + nH_2 \\
3a & \text{45 min, 98% yield} \\
3b & \text{15 min, 99% yield} \\
3c & \text{60 min, 93% yield} \\
3d & \text{30 min, 99% yield} \\
3e & \text{90 min, 97% yield} \\
3f & \text{180 min, 98% yield} \\
3g & \text{240 min, 96% yield} \\
3h & \text{120 min, 96% yield} \\
3i & \text{45 min, 98% yield} \\
3j & \text{180 min, 96% yield}
\end{align*}
\]

Significance: The gold nanohybrid on multiwalled carbon nanotubes 1 (AuCNT nanohybrids) was prepared by layer-by-layer (LBL) assembly of amphiphilic nitrilotriacetic acid diyne lipids (DANTA), cationic poly(diallyldimethylammonium chloride) (PDA-DMAC), and colloidal nanoparticles (AuNPs). The AuCNT-catalyzed aerobic oxidation of silanes (2a–j) was carried out in THF to give the corresponding silanols (3a–j) in 93–99% yields.

Comment: The hydrophobic portion of DANTA was adsorbed on the nanotubes and photopolymerized by UV irradiation at 254 nm. Carbon nanotube–gold nanohybrid 1 was characterized by TEM, GC-MS, ICP-MS, and XPS analyses. The catalyst was readily recovered by centrifugation and reused five times without significant loss of catalytic activity.