

Investigation of Hg Sorption and Diffusion Behavior on Ultra-thin Films of Gold Using QCM Response Analysis and SIMS Depth Profiling

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Electronic Supplementary Information

The drift, noise and Q-factor before Hg exposure for each QCM with different Au electrode thicknesses are shown in Table S1. The values in brackets refer to the coefficient of variance (%) of the QCM Q-factors with 16 samples for each Au film thickness. It is observed that as the electrode film thickness increases, the drift of the sensors increase while the noise is decreased over a 100 minute period. The decrease in noise is probably due to the increasing Q-factors with increasing Au film thickness. The Q-factors (averaged for 16 samples of each film thickness) are observed to increase with Au thickness up to 150 nm and reduced for the 200 nm Au thickness. It was also observed that the 40 and 50 nm Au thicknesses do not oscillate well due to their low Q factors. The QCMs with Au film electrodes of 150 nm shows the highest mean Q-factors with the lowest CoV of only 5%.

Table S1: Drift and noise of the five QCM optically polished Au electrodes thicknesses at operating temperatures of 28 and 89°C. Each film thickness were made in batches of 16 QCMs with the average values presented in the table.

<i>Sample</i>	<i>Operating Temperature (°C)</i>				<i>Q-factor (CoV)</i>
	<i>28</i>		<i>89</i>		
	<i>Drift (Hz/hr)</i>	<i>Noise (Hz)</i>	<i>Drift (Hz/hr)</i>	<i>Noise (Hz)</i>	
40 nm	0.41	± 0.63	0.45	± 2.59	5124 (16%)
50 nm	0.62	± 0.45	0.71	± 1.83	5720 (5%)
100 nm	1.57	± 0.14	1.07	± 0.3	7387 (9%)
150 nm	1.63	± 0.02	1.28	± 0.14	7732 (5%)
200 nm	1.74	± 0.02	3.2	± 0.05	7100 (11%)

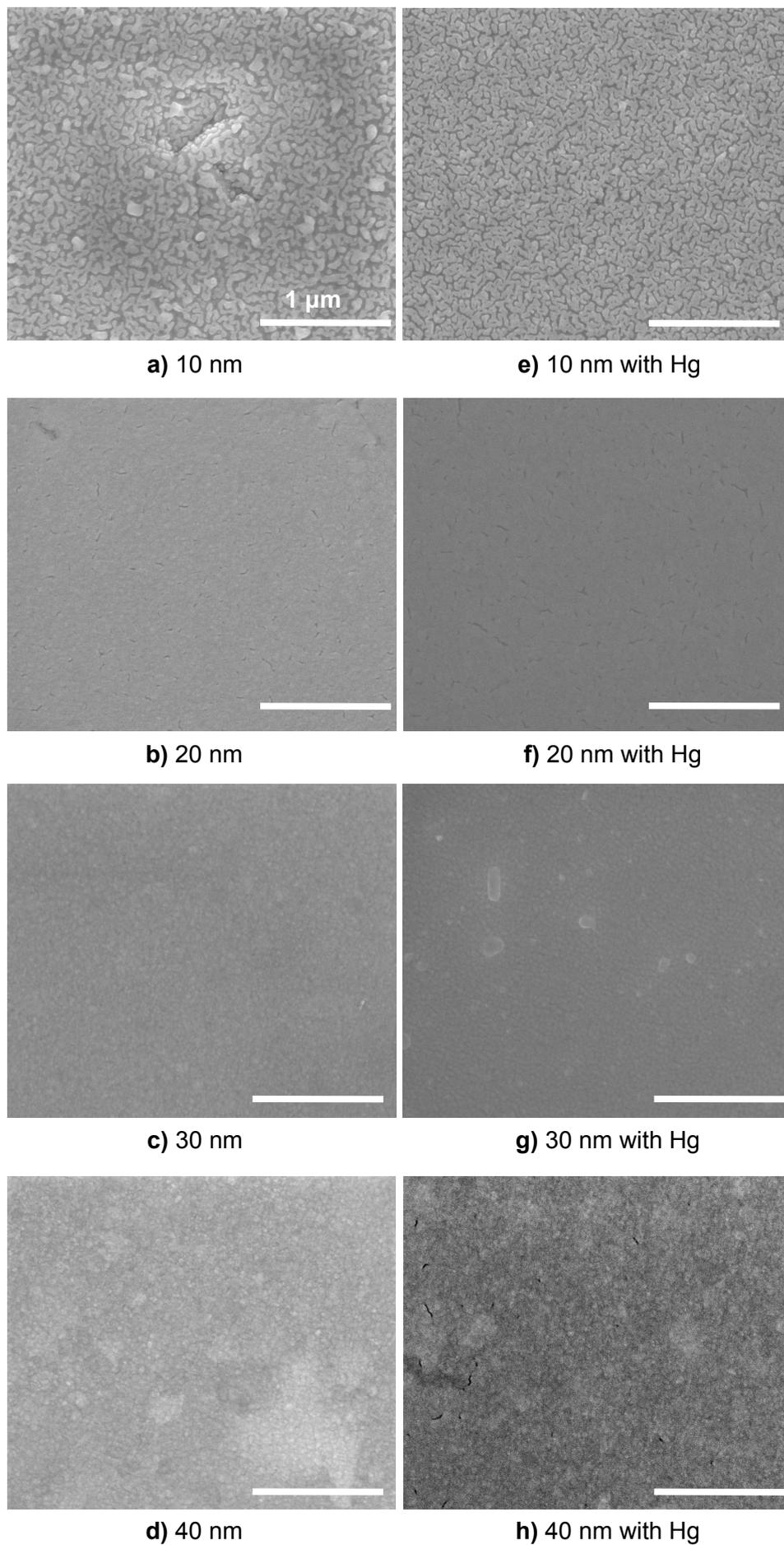


Figure S1: SEM image of Au thin films before (left panel) and after (right panel) exposing to a Hg concentration of 10.55mg/m³ for 14 hours at an operating temperature of 28°C.

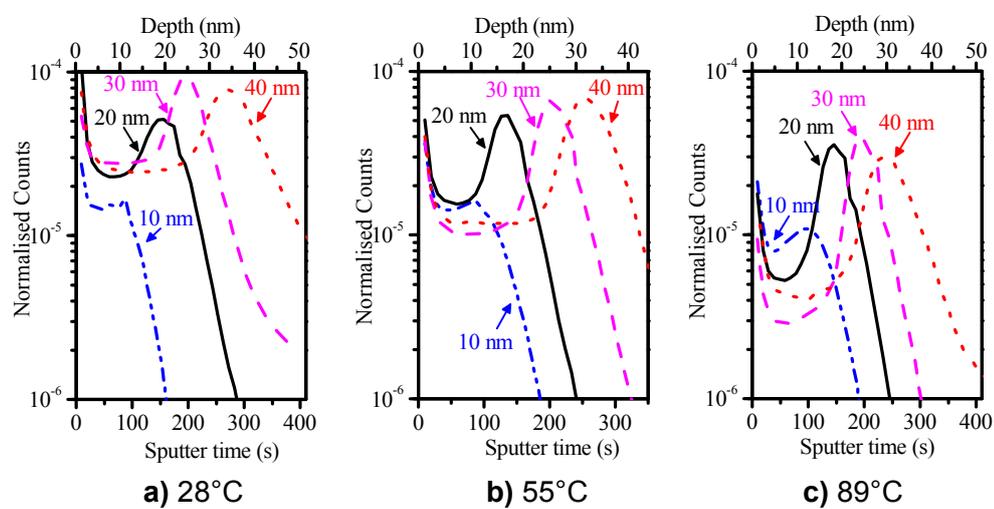


Figure S2: SIMS depth profile of the Au ultra-thin films exposed to a Hg concentration of 10.55 mg/m³ at an operating temperature of a) 28°C, b) 55°C and c) 89°C.