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THE EFFECT OF MONOATOMIC OXYGEN ON CARBON-SPUTTERED QUARTZ CRYSTALS

Eivydas Trioška¹, Mindaugas Viliūnas², Greta Merkininkaitė¹, Simas Šakirzanovas¹

¹Institute of Chemistry, Vilnius University, Naugarduko 24, LT-03225, Vilnius, Lithuania

²Institute of Chemical Physics, Vilnius University, Saulėtekio 9, LT-10222 Vilnius, Lithuania
eivydas.trioska@chgf.stud.vu.lt

Atomic oxygen (AO), a predominant form of oxygen in outer space, offers an effective and minimally invasive way to remove carbon-based contaminants from various surfaces without health and environmental concerns. The efficiency of AO cleaning was estimated using a Quartz Crystal Microbalance (QCM) sensor, carbon-sputtered 6 MHz quartz crystals and a K-type thermocouple, while AO was introduced with a plasma generator.

The experimental procedure is depicted in Figure 1. Step 1: initial mass and ambient temperature measurements

($m_1 = -0.032 \mu\text{g}/\text{cm}^2$, $t_1 = 22.3^\circ\text{C}$) over a 4-minute period. Step 2: mass change and temperature measurements

($m_2 = 0.226 \mu\text{g}/\text{cm}^2$, $t_2 = 20.0^\circ\text{C}$) during an 8-minute period with gas flow (without plasma). Step 3: highest instantaneous mass change and temperature measurements ($m_3 = -50.663 \mu\text{g}/\text{cm}^2$, $t_3 = 70.5^\circ\text{C}$) with plasma for a 4-minute period.

Step 5: mass change and temperature measurements ($m_4 = -5.985 \mu\text{g}/\text{cm}^2$, $t_4 = 24.4^\circ\text{C}$) after a 13-minute cooldown. Results are promising for upcoming measurements, because both instantaneous and long-lasting mass changes are present ($m_3 = -50.663 \mu\text{g}/\text{cm}^2$ and $m_4 = -5.985 \mu\text{g}/\text{cm}^2$ respectively).

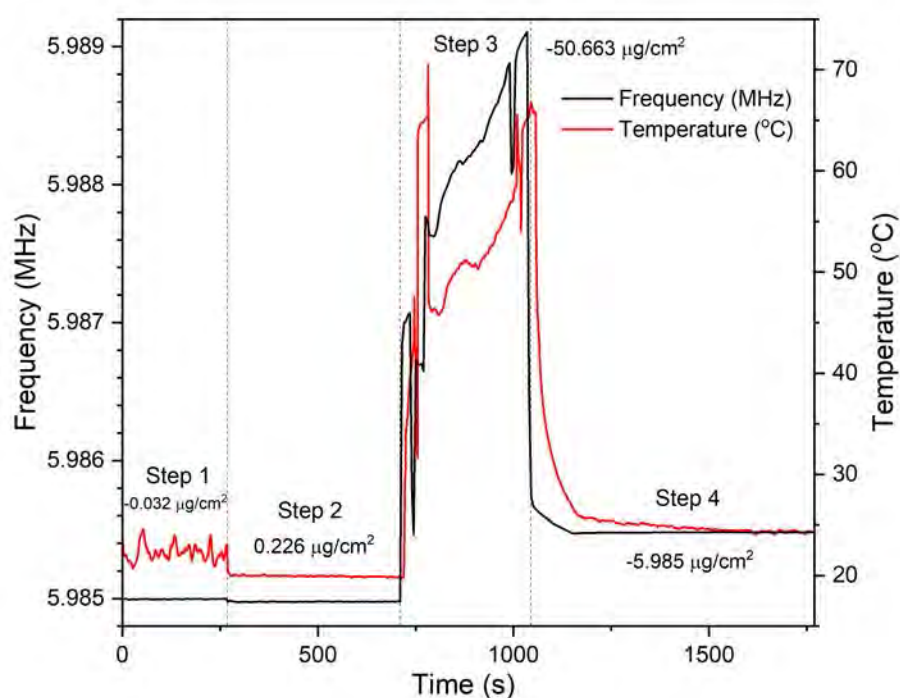


Fig. 1. QCM frequency and temperature relation.

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