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Platinum Patterning by a Modified Lift-Off Technique and Its Application in a Silicon Load Cell

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In micro-electromechanical systems (MEMS) and micro-electronic devices there has been a strong demand for electrode materials which can survive in highly oxidizing and high-temperature environments. Platinum (Pt) is a good candidate for this, because it combines several attractive properties: low electrical resistance, high melting point and high chemical stability. However, the chemical stability is a problem for patterning Pt by wet chemical or dry etching. Standard lift-off seems to be a solution to this problem. A big problem in using standard lift-off is that platinum particles or wing tips (ears) may remain at the edges after lift-off. These wing tips protrude from the surface and may cause short circuits with an opposite electrode placed within 1 μm. Some authors reported briefly on a modified lift-off technique to overcome this problem. Before deposition, a resist is patterned on an insulator to define openings where the metal is to be deposited. Afterwards, a small cavity is etched in the insulator, which is mostly SiO_2. The cavity facilitates the separation of the metal on the resist and the metal in the cavity. In this study the effect of cavity depth and sputtered metal thickness on wing tip formation is investigated. In addition, surface roughness, resistance and hillock formation of the as-deposited metals are measured. The modified lift-off technique has succesfully been applied in a silicon load cell with Ti/Pt electrodes.