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Effect of Au thickness on microwave surface resistance for $Y_1Ba_2Cu_3O_{7-\delta}$ films covered by an Au thin layer

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The temperature dependence of microwave surface resistance (R_s) for $Y_1Ba_2Cu_3O_{7-\delta}$ (YBCO) films covered by an Au thin layer of a different thickness (d_{Au}) was measured in a temperature range of 50-100 K. The YBCO films were coated with Au in order to protect against a degradation in air and to make reliable galvanic contacts. The temperature-dependent microwave surface resistance $R_s(T)$ was measured with a copper end-plate using the microstrip resonator techniques. The Au-coating was proven to suppress the Q-factor of resonator. It was shown that the $R_s(d_{Au})$ displays a nonmonotonic behavior in the low-temperature range with a maximum at $d_{Au} \approx 20$ nm. The observed peculiarity is explained by the transition of the Au film from the island-like to the solid-like state at this value of thickness. This statement is supported by the atomic-force-microscopy investigations carried out for the Au/YBCO films. Therefore, the microwave resistance method can be also successfully used in the study of the growth process of the normal-metal film onto the YBCO surface.