“Improved isolation of micro thermogenerators based on silicon suspended platforms“

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Abstract

This work reports on an improved design intended to enhance the thermal isolation between the hot and cold parts of a silicon-based thermoelectric microgenerator. Micromachining techniques and silicon on insulator (SOI) substrates are used to obtain a suspended silicon platform surrounded by a bulk silicon rim, in which arrays of bottom-up silicon nanowires (Si NWs) are integrated later on to join both parts with a thermoelectric active material. In previous designs the platform was linked to the rim by means of bulk silicon bridges, used as mechanical support and holder for the electrical connections. Such supports severely reduce platform thermal isolation and penalise the functional area due to the need of longer supports. A new technological route is planned to obtain low thermal conductance supports, making use of a particular geometrical design and a wet bulk micromachining process to selectively remove silicon shaping a thin dielectric membrane. Thermal conductance measurements have been performed to analyse the influence of the different design parameters of the suspended platform (support type, bridge/membrane length, separation between platform and silicon rim) on overall thermal isolation. A thermal conductance reduction from 1.82 mW/K to 1.03 mW/K, has been obtained on tested devices by changing the support type, even if its length has been halved.