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A plasma-based pre-treatment for low temperature bonding of silicon wafers[1] NICHOLAS BRAITHWAITE, JAN KOWAL, The Open University, UK, TONY ROGERS, Applied Microengineering Limited — In the fabrication of micro and nano electromechanical systems (MNEMS), there is a demand for adhesive-free, low-temperature wafer bonding. These constraints arise from the need to avoid issues relating to thermal strain and to unacceptability of high temperature processes late in the manufacturing sequence. It has been known for some time that high strength wafer bonding can be achieved by exposure to oxygen plasmas for a few minutes followed by a 200 deg C, 60 minute anneal step. Low pressure and atmospheric pressure routes have been demonstrated commercially. Our studies show that a more effective pre-treatment involves exposure radicals generated in an oxygen plasma, avoiding deleterious effects of excessive ion bombardment and UV flux. In the present configuration the plasma source is an annular arrangement that surrounds a pair of wafers; plasma excitation uses mesh electrodes, and mains frequency voltage. Neutral species diffuse from the source across the surface of the wafer, where they activate the bonding process; the mechanism is yet to be fully elucidated, but has been shown to work effectively.

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