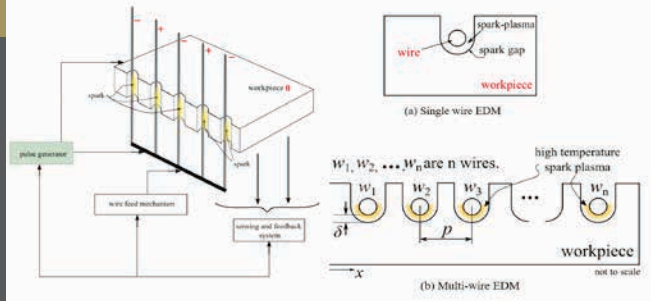
Multi-wire EDM for Slicing Semiconductor Ingots



Problem Statement: Semiconductor wafers are ultra-thin plates (120-250 microns thick) of semiconductors used to make solar cells or integrated circuit (IC) components. It is proven that wire electric discharge machining (wire EDM or WEDM) can reduce the material loss from 40%, in the conventional wire-sawing technique, to 15%. However, one of the main problems in the practical realisation of multi-wire electric discharge machines (EDM) is the requirement of very high tension - 85-90% of the failure strength of wires. More tension makes multi-wire EDM susceptible to wire-breakage problems, and lesser tension reduces cutting accuracy with multi-wire EDM. Therefore, the problem is to reduce wire-tension-requirement without losing cutting accuracy.

Uniqueness of the Solution: To this end, two electrical supply schemes are proposed for multi-wire EDM, such that the wire-wire forces and hence the required tension is reduced to 20-30% of the tension required with the present scheme. The current innovation proposes novel electrical supply schemes, such that the tension requirement in multi-wire EDM is reduced without sacrificing the machining accuracy. The schemes are unique because all the earlier solutions for the problem were structural in nature. Therefore, they were amenable to wear and tear besides ageing. Therefore, this is a preventive measure to the problem of wire-tension-requirement as against the remedial nature of solutions proposed to date.

Current Status of Technology: Proof-of-concept demonstrated analytically. The force computations are done by employing the proposed schemes. It is shown that the tension-requirement in the multi-wire EDM reduces to 20-40% to that of the tension required in the present schemes.

Societal Impact: The multi-wire EDM has the potential to establish a starting point for indigenous semiconductor manufacturing in India.

Patent(s): Filed

Relevant Industries: Electric Power, Manufacturing, Semiconductor Fabrication, Solar Photovoltaics, Metal Manufacturing, Sputtering Industry, Magnet Manufacturing.

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