# The Effect of Linewidth Scaling on Hydrostatic Stress in Passivated Interconnects

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## ABSTRACT

In this study, numerical work using ANSYS and analytical work based on Eshelby models are performed to examine the effect of linewidth scaling on the hydrostatic stress in passivated metal interconnects. Aluminium and copper interconnects of thickness 1 micron and linewidth ranging from 10 nanometers to 10,000 microns, passivated with phosphosilicate glass (PSG) are studied. Results from analytical models agree well with numerical results and relevant experimental results. Results show an increasing trend of hydrostatic stress with linewidth for narrow interconnects, and decreasing trend of hydrostatic stress with linewidth for wide interconnects, with a maximum hydrostatic stress at 1 micron linewidth. The calculated maximum hydrostatic stresses are 463 MPa and 534 MPa for aluminium and copper interconnects, respectively. The hydrostatic stress in copper interconnects for all linewidths is larger than that in aluminium interconnects due to copper being a stiffer material than aluminium. It is also observed that there is a large scaling effect. For example in the case of aluminium interconnect, stress values vary between 50 MPa and 463 MPa.

**Keywords:** Microelectronic reliability, Scaling effects, Passivated interconnects, Finite element Method

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