

The problem to solve: delamination

The production of integrated circuits often involves the stacking of different materials – metals and dielectrics - in multilayer structures on a silicon substrate. During manufacture the layers may separate (delamination), leading to major equipment downtime. The semiconductor industry needs a reliable test method to explain this problem and to eliminate its risks.

A step towards the solution

Researchers have used neutron reflectometry to examine wafers in the process of delamination (figure 1). They found an intermediate layer in the structure of the wafer, composed essentially of hydrogen (figure 2).

Figure 1. A 300 mm wafer exhibiting delamination

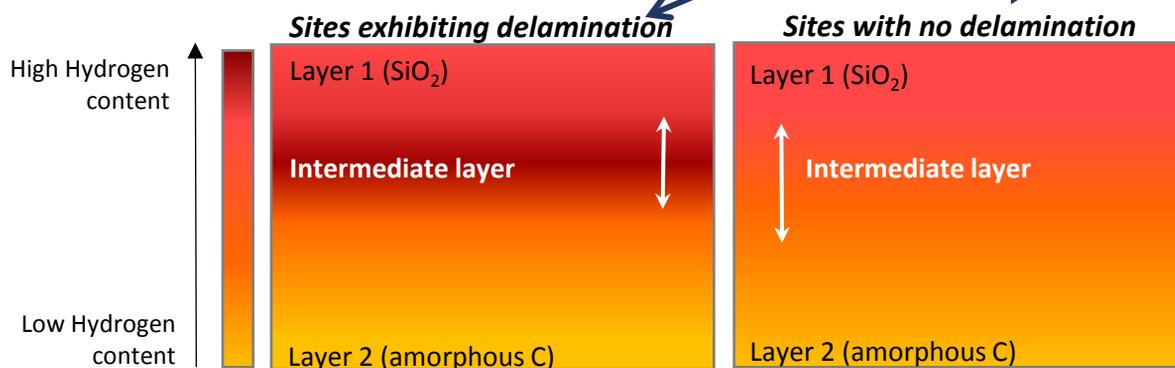


Figure 2. Schematic view of hydrogen content within the layers investigated. A thinner intermediate layer with a high H-content can be seen in the wafer undergoing delamination.

Neutron measurements have been performed to characterise the thickness, roughness and density of the intermediate layer, for both delaminated and non-delaminated wafers. Hydrogen accumulation was identified as being responsible for the lack of adhesion between the layers.

The consequence

By characterising the layers in these structures, we can now identify the parameters requiring control during the manufacturing process, thus minimising the risk of failure.

[Reference: J Segura-Ruiz, P. Gutfreund, G. Imbert, A. Ponard, R. Cubitt, *J Appl Phys*, 215302 (2015)]

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