



David Lammers

## The Donut Mystery

April 9, 2008

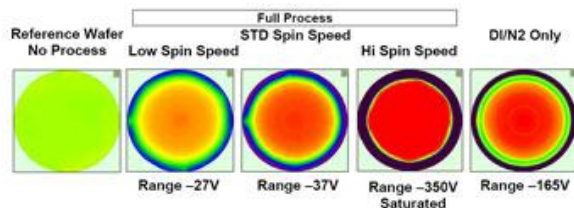
John Halladay, a clean process manager at Spansion's Fab 25, brought a good mystery to Sematech's Surface Preparation and Cleaning Conference here last week.

While yield losses often are at the edge of the wafer, Spansion had a donut-shaped area at the center of the wafer populated with bad die. At first, engineers thought the culprit was the trench plasma-etch process.



The Spansion team brought in detectives from [SEZ America](#) (Phoenix) and [QCept Technologies](#) (Atlanta). Their [slide deck](#) includes some intriguing visuals.

Halladay said the Spansion-SEZ-QCept team used the ChemitriQ system from QCept to create about three million images. The ChemitriQ system performs a non-optical wafer-level scan that relies on the electronic work function of the materials under scan. As part of the surface charge study, the team studied the deionized water (DIW) and realized that frictional charge was building up between the water and the surface of the wafer. The spin speed was high enough that "the electrons had no place to go," Halladay said, creating arcs on the wafer that created what looked like bullet holes.



The team then had to figure out a solution to the frictional charging caused by the spin speed of the water at the surface of the wafer. Halladay said carbon dioxide (CO<sub>2</sub>) was added to reduce the resistivity of the dionized water, which "eliminated the arcing completely."

While QCept was established several years ago based on technology developed at the Georgia Institute of Technology and has installed inspection systems in the field, the Sematech SPCC conference resembled a coming-out party for QCept, which played a role in three papers at the meeting in Austin.

The two other presentations QCept had a hand in came from a [CEA-Leti – QCept inspection effort](#), and a [Semitool](#) (Kalispell, Mont.) project to develop a [post via wet etch cleaning process](#).

The Semitool-Qcept presentation included more pictures of wafers with the bad die collected – you guessed it – at the center of the wafer. The problem was outgassing from the vias, creating the kind of non-visual defects (NVDs) which the ChemitriQ system is adept at finding. These NVDs are caused by trace metallics, organics/ inorganic residues, and the kind of surface charging which the Spansion-SEZ team dealt with.

Engineers teaming together to solve a problem are what make manufacturing an exciting field. The doctors on the TV drama “House” or the forensic scientists on “CSI” don’t have anything on people like John Halladay.

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