Introduction

The stud-pull test measures the bond strength of dies and other flat components to the substrate. This is a complimentary technique to the more common die shear test, with both methods being used to get a full understanding of the die-substrate bond strength. Stud-pull is carried out in pure tension, so the stresses on the bond are less complex, so the bond performance is easier to model.

An important industry trend is for dies to become wider and thinner, which makes them more difficult to test using shear, so pull testing is becoming an essential technique. Shear tests can cause bending of the die or substrate during the test, so the stress state becomes a combination of shear and tension. This bending gets worst as the die area increases relative to the thickness of the die. Stud-pull testing eliminates this issue.

Nordson DAGE bondtesters support two methods of pull testing; a vertical pull test, that allows access to the smallest and most difficult to reach components, and a horizontal pull test that can test the largest components, with a full load of 200 kg force.

The challenges of a successful stud-pull test are:

- Achieving a perfectly perpendicular pull off the substrate, thus minimizing peel forces
- Securing the substrate during the test, so that the die can be tested without breaking the substrate first
- Using a load cell that can measure small pull tests accurately yet has sufficient pulling force to test large components
The Vertical Pull Method

Nordson DAGE pull cartridges are used for the vertical stud-pull method. A wide range of rapidly interchangeable cartridges are available, from the P25G, with a 25g capacity, up to the P100KG. The package or support plate is secured using the standard workholder and the stud is bonded to the die surface using a high strength adhesive, such as cyanoacrylate. The die is then positioned under the cartridge using the high precision xy stage that ensures the stud is pulled absolutely vertically during the test.

The Horizontal Pull Method

To react to the loads of high force pull testing, the horizontal pull method uses a cup that neatly fits around the edge of the die when the load is applied. The die being tested is typically much larger for these tests, with a standard stud of 8x8 mm bond area available. A wide range of standard cup shapes and sizes are available, with custom cups also offered. The cup supports the substrate all around the die edges so that the substrate does not twist or buckle during testing. This method uses a Nordson DAGE shear cartridge (such as S200KG) and a fixture. When the substrate is particularly flexible, an aluminium plate can be bonded to the back of the substrate.