Promobond® AP 2

Adhesion promoter

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Adhesion promoter for next generation packaging

Up to **4.7x**

shear force improvement with various components

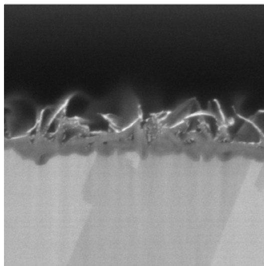

Figure 1:
Microcope FIB cross-section of Promobond® AP 2 treated Cu surface

Cu-mold / PI adhesion strongly determines the device reliability

Next generation heterogeneous integration in packaging processes requires the combination of a variety of different materials with different coefficients of thermal expansion (CTE).
In a package, thermal expansion is mainly dominated by die and mold, which creates a high strain on thin RDL Cu lines. Temperature changes hence lead to increased stress due to different thermal expansion of the materials and thus to potential Cu RDL fractures. This effect is increased with ever smaller Cu lines. To minimize the risk of yield reduction (e.g., via uncontrolled oxidation), the Cu deposits need to be protected against external influences. Additionally, the device reliability can be increased by improving the Cu-mold/PI adhesion respectively the Cu ductility.
For pillars, the adhesion of the mold material to the Cu surface is crucial to avoid gap formation. A good ductility and adhesion of mold/PI to the Cu surface therefore has a significant influence on the overall performance and reliability.

Promobond® AP 2 significantly increases the adhesion between Cu and mold/ PI

Promobond® AP 2 is Atotech's next generation adhesion promoter for mold/PI material on copper. It significantly increases the reliability of Cu RDL/pillar structures due to the controlled and self-limiting formation of dense oxides. This ensures good ductility of the PI/Cu or mold/Cu due to composite formation and leads to better mechanical properties of the resulting structures. The possibility of batch processing additionally allows cost efficient processing.

Quickfacts about Promobond® AP 2

- Adhesion promoter for mold/PI material on Cu
- Increased reliabilities
- Possibility of batch processing ensures cost efficient processing

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Promobond® AP 2 –
Increased adhesion between Cu and mold/PI

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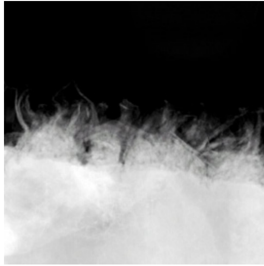

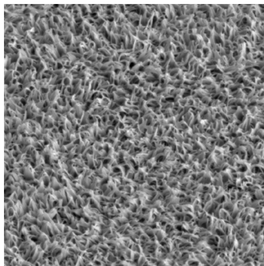

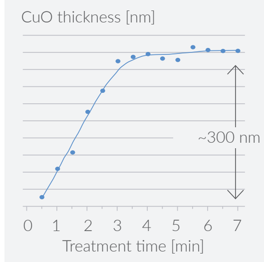

Figure 2: TEM image

Figure 3: SEM – top view of Promobond® AP 2 treated Cu surfaces

Figure 4: CuO thickness is tailorable via process conditions

Needle structures increase adhesion by Cu /polymer composite formation

With the application of Promobond® AP 2 needle-like Cu oxide structures are formed on the Cu surface. These needles allow the formation of Cu-polymer composites and hence significantly increase the adhesion of the polymer (e.g., mold, PI) and the underlying Cu layer resulting in higher ductility.

Controlled, self-limiting oxide formation prevents uncontrolled oxidation

Uncontrolled oxide growth can be caused by diffusion of oxygen through PI material. This can significantly decrease the device reliability and is often visible when performing reliability tests. Promobond® AP 2 leads to the controlled and self-limiting formation of oxides on the Cu surface before the mold/PI application and hence successfully prevents further uncontrolled oxidation. The Promobond® AP 2 application hence leads to significantly increased device reliabilities.

Additional features and benefits

- Ensures good ductility of the mold/Cu combination
- Minimal required exposure time
- Excellent mechanical properties of Cu RDL and increased reliability
- Possibility of batch processing ensures cost efficient processing

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