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Pixel detector hybridisation with anisotropic conductive adhesives

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Hybrid pixel detectors require a reliable and cost-effective interconnect technology adapted to the pitch and die sizes of the respective applications. During the ASIC and sensor R&D phase, and for some small-scale applications, such interconnect technologies need to be available for the assembly of single-dies. Within the CERN EP R&D program and the AIDAinnova collaboration, innovative pixel detector hybridisation technologies are studied, targeting vertex-detector applications at future colliders. In this framework, an in-house single-die flip-chip bonding process based on Anisotropic Conductive Adhesives (ACA) is in development. The ACA interconnect technology replaces the solder bumps with conductive particles embedded in an adhesive film or paste. The electro-mechanical connection between the sensor and the ASIC is achieved via thermo-compression of the ACA using a flip-chip device bonder. The required pixel-pad topology is achieved on single-dies with an in-house maskless Electroless Nickel Immersion Gold (ENIG) plating process that is also under development within the project. This contribution presents recent development and results of the ENIG and the flip-chip bonding process, qualified by Timepix3 ASICs and sensors with 55 µm pixel pitch and 12-14 µm pad diameter.

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