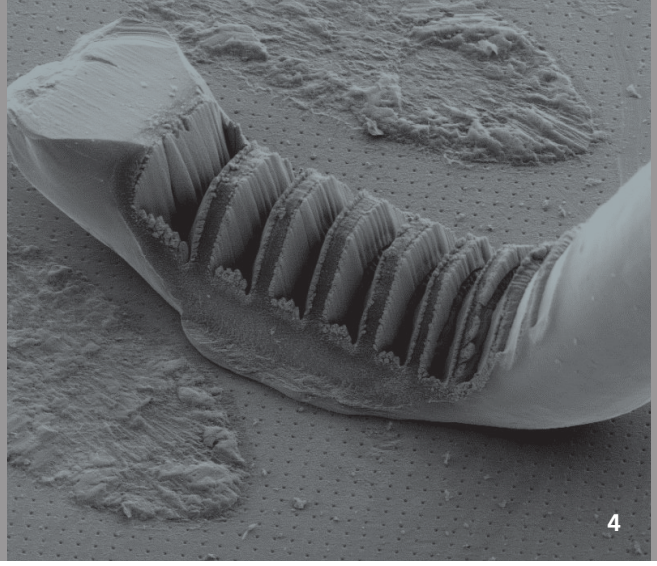

LASER STRUCTURING OF BONDING WIRE CONNECTIONS

Task

Advances in power electronics and increasing the efficiency of these components require new set-up and connection techniques with higher electrical and mechanical reliability and reproducibility. Wire or ribbon bonding is an established electrical connection technology, which, however, places considerable forces to the contact surfaces with larger cross sections and connection sites. For this application, the achieved level of reliability should be retained or improved by means of selected laser cuts. This is done on the back of carrier substrates (direct copper bond) directly below the power devices and to the contacting points of the wires.

Method

The laser structures are inserted so as to improve the thermomechanical properties of bonding wire and terminal connections. When the cuts were introduced, the build-up of tension thereby hampers the material from developing thermally induced and unavoidable elongations. The cuts have to be made such that the processed structure or the component is not weakened or even damaged. To ensure this, ultrashort laser pulses in the picosecond range have to be used.

Result

To generate stress-reducing cuts in bonding wires, ablated cavities were introduced in the wires with different depths and arrangement after the bonding process. It could be shown that the electrical function of bonding wire and assembly was not damaged. Subsequently, the assemblies were subjected to an endurance test that showed a significantly improvement in the reliability of the connection.

Applications

Industries are just beginning to enter many branches with power electronics; in terms of increasing efficiency and reliability, however, these electronics are still far from having fully penetrated the market. In particular, as renewable energy resources are increasingly being used, a wide range of inverters with high long-term stability will be required. With the method shown here, laser processing has positively changed the ageing behavior of electronic components and can specifically increase their service life.

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3 Comparison of an untreated and a laser-structured bond.
4 SEM image of a 0.7 mm thick bonding wire with laser-generated cuts.