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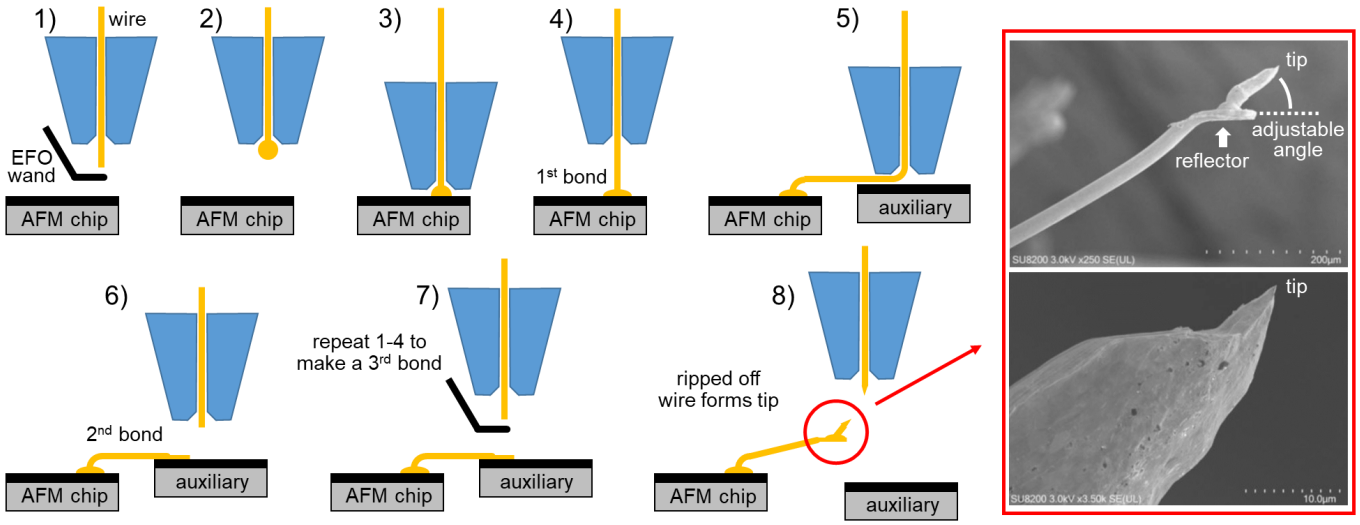
Licensing Opportunity

Fabricating fully metallic AFM probes by wire-bonding



An Electronic Flame Off (EFO) wand melts the wire forming a ball, which is then pressed against the AFM chip, forming a strong first bond. The second bond is established by only pressing down the wire on the auxiliary chip. Steps 1-4 are repeated to form a third strong bond at the end of the cantilever. The wire is ripped of quickly to form the fine AFM tip.

Application

This invention offers a method for the fast production of fully metallic probes for atomic force microscopes (AFM) at radically reduced cost. The underlying wire-bonding technique is chemical-free (no etching steps) and environmentally friendly.

Features & Benefits

- AFM tips below 10 nm
- Applicable in static and dynamic (5 kHz - 650 kHz) modes
- Comparable measurement data as commercial probes that are manufactured with conventional methods

Publications

- Patent pending, WO2021/084115

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Technology Readiness Level

1 2 3 4 **5** 6 7 8 9

Background

AFM probes are consumables. They get easily contaminated or wear off and require constant replacement. Conventional AFM probes are fabricated in a multi-stage process such as photolithography and with multiple cycles of chemical / physical etching steps on silicon (nitride) wafer. Furthermore, they need to be coated with thin layers of metal to improve their operational performance. Such labour- and time-intensive processes lead to high costs and relative high scrap rates of the short-lived probes.

Invention

The core of the invention is the adaptation of the well-known wire-bonding technique. It is a soldering technique, which connects electronic components with ultrathin metal wires. When the machine is wrongly operated, sharp tails form on the soldering spots. This disadvantage in wire-bonding of microelectronics becomes the advantage for the production of fully metallic AFM probes. Any standard AFM support chip can be a starting point for this new fabrication method as long as it is metallic or metallized. The cantilever is made from a wire with a strong bond to the support chip and a weak bond to an auxiliary substrate, which is highly polished (see figure above). Later, the cantilever will be detached from the auxiliary substrate, leaving it with a reflective bottom surface. This optical reflector on the cantilever is necessary in AFM operation for tracking the tip position with a laser beam. The fine AFM tip is formed by adding another strong bond to the end of the cantilever and tearing off the wire in a swift move. The whole process takes only a few seconds, which makes it suitable for upscaling to industrial production volumes.