

Nitinol Thin Film Micro Tools

*Dr. Christoph Chluba, Gerd Siekmeyer, Dr. Christoph Bechtold, Dr. Rodrigo Lima de Miranda,
Acquandas GmbH*

Miniaturization is continuously progressing in medical and industrial sectors, which makes handling and assembly of small components more challenging and increases the need for specialized micro tools. In this white paper, we discuss three technical cases that show how Nitinol (NiTi) micro tools can help to overcome challenges that arise with miniaturization. Nitinol is a superior material choice compared to alternatives like tungsten or stainless steel since it exhibits an extremely high elasticity of up to 8% without plastic deformation. This is especially interesting for small and delicate tools which are easily exposed to high stresses and deformations during usage.

Case 1: Preparation of micro cables and wires

Micro cables are used in a variety of medical applications e.g. for minimally-invasive catheter components that enable sensing or stimulation. Due the demand for both decreasing catheter diameters and increasing channel number in each cable, wire diameters need to be reduced. Wire sizes of AWG52 (20 μm) are already in use, but their handling is difficult and delicate. Prior to being able to connect a cable to a device by soldering or glueing it has to be prepared accordingly, which includes several processes like stripping a precise length of cable sheath, separating wires and removing insulation. High precision tools made of thin film Nitinol can be used to fulfil this task. The high structuring resolution of microsystem technology fabrication processes enables the design of precise and specialized tools for each process: cutters, scrapers, hooks or clamps.

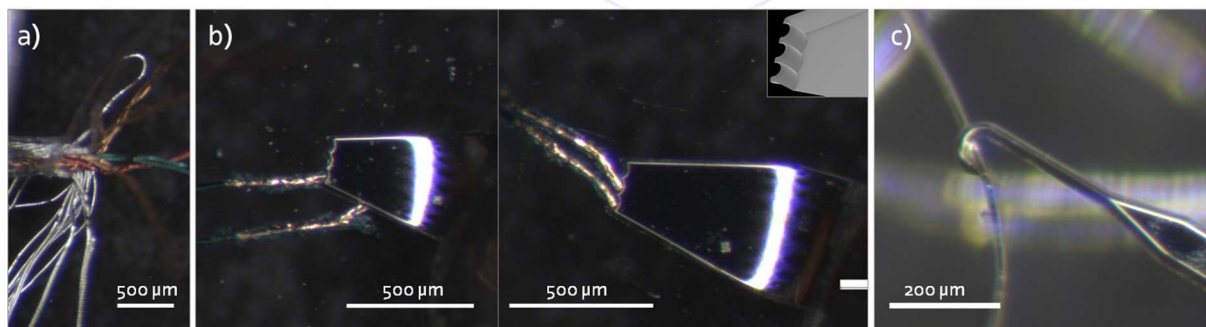


Fig. 1: a) Stripped AWG 52 cable; b) Scraper tool to remove wire isolation, insert shows tool tip, for scale and higher magnification refer to figure 2; c) micro hook tool to separate individual wires.

Fig. 1 shows two generic Nitinol thin film tools for the preparation of a shielded 5 channel AWG52 twisted pair cable: a scraper tool with 20 μm channel width and a micro hook, equally optimized for wire diameter.

Case 2: Micromanipulation probes for microscope (SEM, optical)

Micromanipulators are used to interact with specimens during microscopical investigations. Typical applications are electrical contacting where round tips are commonly used. Tips made of NiTi have the advantage that spring contacts can be designed easily due to the intrinsic superelastic properties of NiTi. Another application is the movement or mechanical machining of small objects like particles, fibers or cells. The high freedom of design allows the fabrication of tip shapes which are beyond the capabilities of laser ablation or ECM (electrochemical machining) for specialized micromanipulation tasks. An example of highly complex probe shapes is shown in Fig. 2

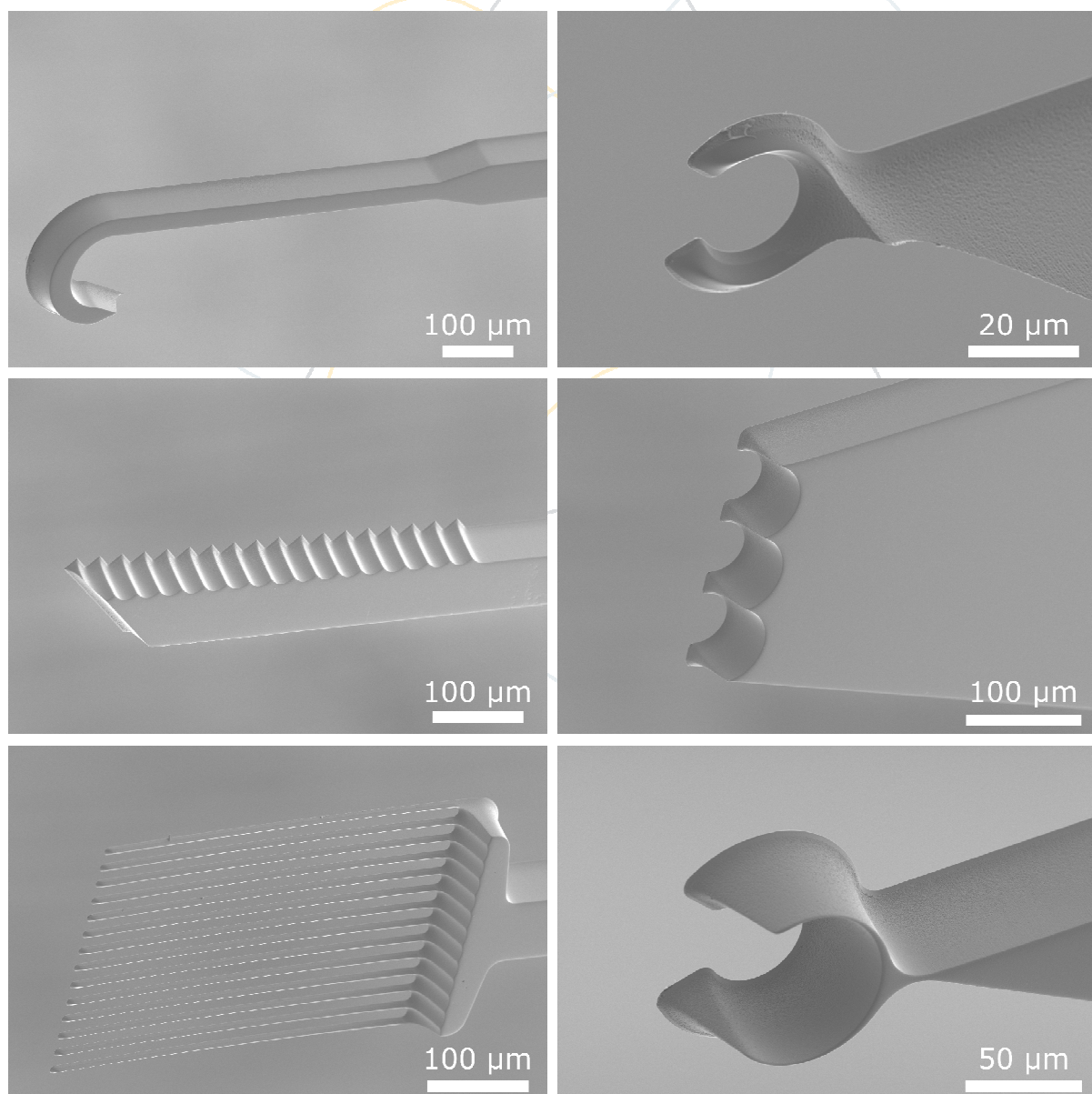
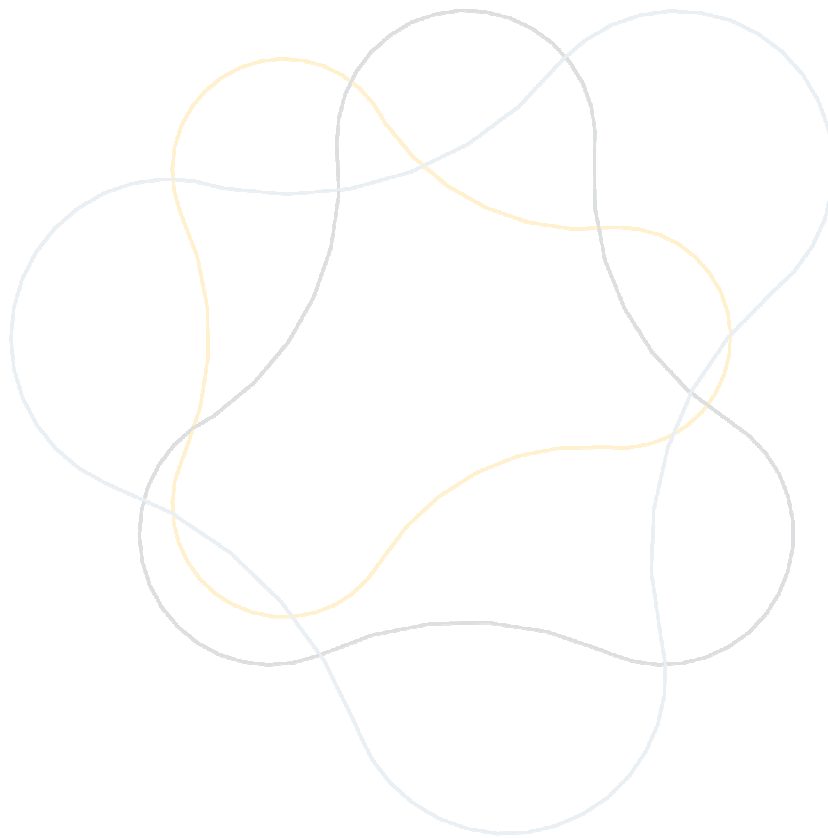


Fig. 2 SEM images of various tools

Case 3: Medical tools

With increasing number of minimal invasive surgical techniques and robotic assistant systems the size of surgical instruments for delicate and sensitive tissue like eye or brain tissue will further decrease. Nitinol is an FDA approved, well known and widely used material in the medical sector as implant as well as part of medical instruments. Micro tools like hooks and blades can be realized by this technology, see also Fig. 2.

Due to a unique additive manufacturing technology, high precision micro tools can be fabricated cost efficiently, with high volume prices <1€. As OEM supplier, ACQUANDAS supports you in finding and realizing optimized designs for your application.



About ACQUANDAS GmbH: ACQUANDAS GmbH is a technology company that supplies thin film components to the healthcare industry – in particular to medical device OEMs – and other industrial markets, such as the automotive and consumer electronics industries. ACQUANDAS is located in Kiel, Germany.

Based on state-of-the-art microsystem technology processes, we fabricate an entirely new generation of metallic components for applications in medical devices and many other products. The combination of properties that our devices have is unique: miniaturized structures with high geometrical complexity, integrated micro-electrode arrays, increased radiopacity, high feature resolution, excellent biocompatibility and improved mechanical properties!

We look forward to working with you...