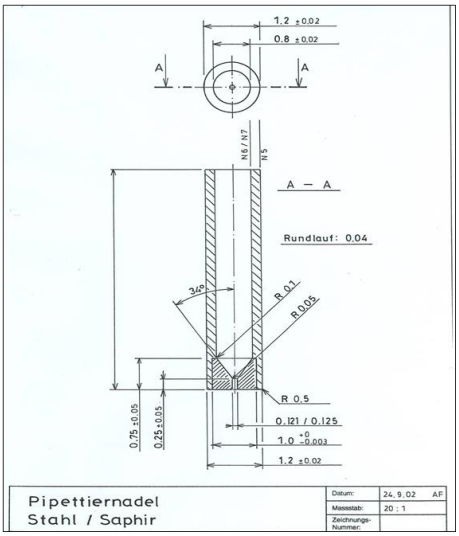
New needle for nano pipetting

Steel needle with built-in sapphire nozzle, inside and outside with sol-gel nanocomposite coating

Introduction

The ongoing development in the fields of clinical diagnostics, drug discovery and molecular biology leads to an enormous number of individual analyses, which can only be performed at economically justifiable costs thanks to increasing miniaturization and automation. Liquid handling is probably the most demanding sub-process in bio-analytics. The perfect mastery of the precise transfer of the smallest amounts of liquids can only be achieved with high-precision tools.



Drawing pipetting needle with sapphire nozzle

Problem

Nanosol AG has specialized in the manufacturing and supply of precision mechanical components for many years and has established itself as a major supplier to OEM device manufacturers in Europe and overseas. Our customers are involved in the development and manufacturing of devices for pipetting small amounts of liquids. The challenge: Aspiration and contact-free dispensing of micro- and nanolitre volumes in highly parallel microplate format (96/384/...). With the life sciences industry's urgent need to massively reduce the volumes of test preparations, the demand arose for relatively inexpensive, parallel pipetting devices that can dispense freely selectable volumes from 100 microlitres down to 50 nanolitres and less without contact.

Our technology

Thanks to many years of experience in the field of precision engineering and coating, Nanosol has developed a new type of stainless steel needle with a built-in sapphire nozzle, with which the specified goal, i.e. aspiration and contact-free dispensing of a few nanolitres, is achieved.

This new type of needle is characterized by the fact that the tube and nozzle are made of completely different materials. Thanks to special and long-term know-how, nozzles with extremely small outlet openings can be manufactured while maintaining the highest surface quality and the smallest manufacturing tolerances.

The nozzle installed in the tube channel consists of an extremely hard, ceramic or mineral, chemically resistant material such as zirconium oxide, sapphire or ruby with a Vickers hardness of > 2500 HV.

To improve the surface properties, the inner and outer surfaces of the steel tube and the sapphire can be treated with a hydrophobic sol-gel coating. These organic-inorganic nanocomposite coatings have a glass-ceramic basic structure with cross-linked SiO_2 molecules, which bond firmly to the metal or sapphire surface.

The main advantages of the coating are the drastic reduction of carry-over, reduced adhesion of blood, serum, urine and bacteria, easier cleaning, precise analysis results, the formation of a diffusion barrier and finally a considerably longer service life of the needle (patent pending).

Summary of specifications

Tubes:

Material:	1.4435 AISI 316L (stainless steel)
Length:	arbitrarily selectable (typically 20-80 mm)
ID:	arbitrarily selectable (typically 0.8 +/- 0.02 mm)
OD:	arbitrarily selectable (typically 1.0 +/- 0.02 mm)

Nozzle:

Material:	Sapphire (Al_2O_3)
Hardness (acc. to Vickers):	> 2500 HV
Surface quality:	polished N1
Ø of nozzle:	80, 100, 120, 150, 180 µm
Tolerance Ø:	+/- 2 µm

- Further, even smaller nozzle diameters are under development.
- Nozzles made of other materials such as zirconia etc. are available on request.

Coating:

The inner and outer surfaces of the steel tube and the sapphire are coated with a hydrophobic sol-gel nanocomposite.

Advantages of the coating:

Reduced carry-over; reduced adhesion of blood, serum, urine and bacteria; easier cleaning; precise analysis results; diffusion barrier; longer needle life