

## *Prototype 14:*

# **New Commercial SThM platform CSI**

*Lead Partner: Concept Scientifique Instruments (CSI), France*

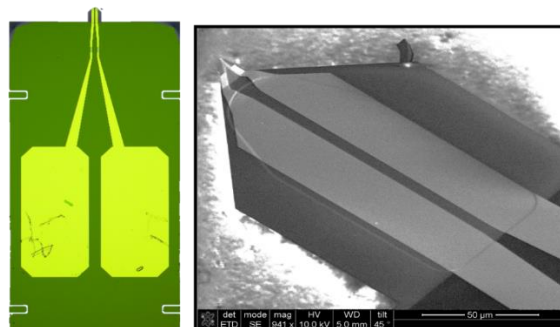
CSI has developed new solutions in order to use probes designed by KNT. These probes are used to map the temperature and thermal conductivity of sample surfaces and to detect hot spots in submicron scales in electronic devices. CSI has designed the electronics and the probe holders to drive those probes. It is now possible to drive probes from 2 to 8 terminals. The 2 terminals ones use a resistor located at the apex of the probe. More terminals can be used in order to separate the sensor and the heater. It has also been planned to drive a thermocouple. The measurement with the sensor can use 2 or 4 terminals depending on the type of measurements (2 points or 4 points measurement). The heating can use 1 or 2 heaters which mean 2 or 4 terminals. 2 terminals are necessary for thermocouple. CSI has different kinds of probe holders and different prototypes of electronics in order to be able to drive all kind of probes. The first module, able to drive last probes from KNT (KNT-SThM-2an) is already available for the market.

## **Key Benefits**

- *Compatible with all kind of probes*
- *Flexible electronic enabling the user to choose his configuration*
- *Low starting price*

## **Probe Holders**

Here after, we can see an example of KNT probe that CSI has to drive. The cantilever holder designed for 2 terminals probe is able to receive the probe directly without any probe preparation. Figure 1 below shows an optical image and an SEM image of one of these probes. (Photos provided by KNT)



*Figure 1: Optical image (left) of one of batch fabricated SThM-KNT-2an probe (left) and SEM image of the entire cantilever.*

Those probes will be used with the CSI AFM that we can see on the Figure 2. To be able to use specific probes as it is the case in this project, only the probe holder has to be redesigned. The probe has to be installed on the probe holder that is designed to allow an easy mounting like a normal probe for AFM. Then, the probe holder is inserted in A.



*Figure 2: AFM Microscope from CSI*

The probe holder used for this kind of probes is shown on Figure 3. To gently insert the probe, the probe holder is placed on a specific tool that lifts simultaneously the 2 contacts to allow an easy mounting of the probe. It is then easy to test the value of the resistance of the probe without any risk to damage it. As soon as resistor and contacts are checked, the probe holder can be inserted inside the microscope. (Arrow A on Figure 2)



*Figure 3: Probe holder with 2 terminals*

Other probe holders are available depending of the number of terminals and geometry of the probes.

## Electronics

Different electronics were designed in order to drive all kind of probes from 2 terminals to 8 terminals with some options. The detection of such a low signal is based on Wheatstone bridge. The bridge should be balanced before starting measurements. It is done manually thanks to a potentiometer. The reading is given by a display located on the electronic box. This adjustment has to be checked for each probe and before each measurement. In order to make measurement easy to use, CSI has developed a digital solution to avoid the user to have to adjust the bridge. This analogic part of the electronic is replaced by a digital part and the balanced of the bridge is done automatically. So, CSI proposed different options so that the user can adjust the configuration to his need. The module for the last probes from KNT (KNT-SThM-2an) as well as the digital control of the bridge are already available on the market.



Figure 4: Electronic option for Digital automatic adjustment based on microcontroller

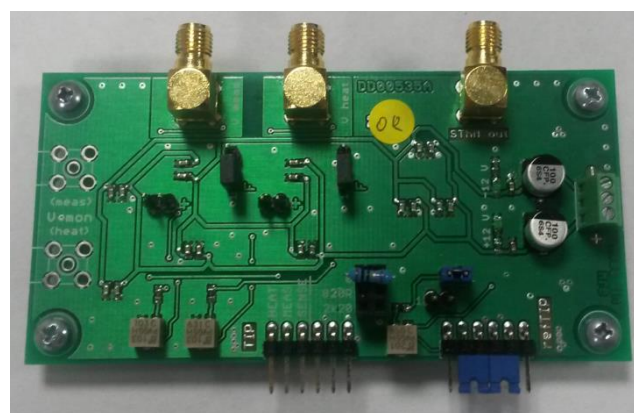


Figure 5: Last board that was designed is for 6 or 8 terminal-probes. Tests will be made as soon as new probes are ready

## Applications

- Mapping of topography, temperature and thermal conductance of a surface.
- Detecting hot spots on surfaces.
- Heating a surface.
- Characterisation of polymer layers, semiconductor & electrical devices, biological samples, and thin films.

Here after, some examples of measurements run on CSI Nano-Observer using probe holders and electronics designed in this project are shown.

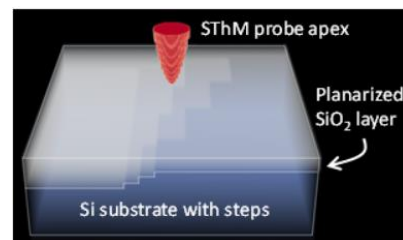
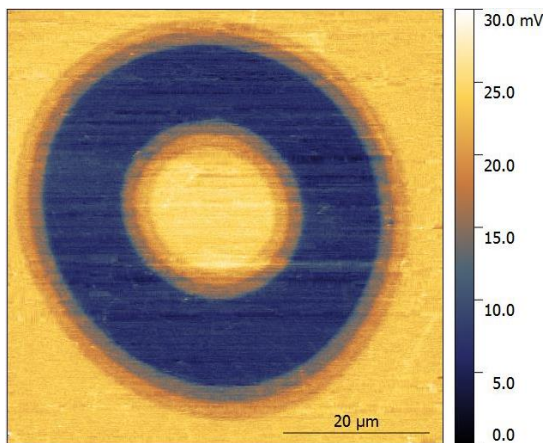


Figure 5:  
Left\_ Thermal image of buried steps passive test sample from  
obtained using CSI Nano-Observer with a KNT probe @CSI  
Rigth\_ .Schematics of sample (FDM calculation mesh) @CMI

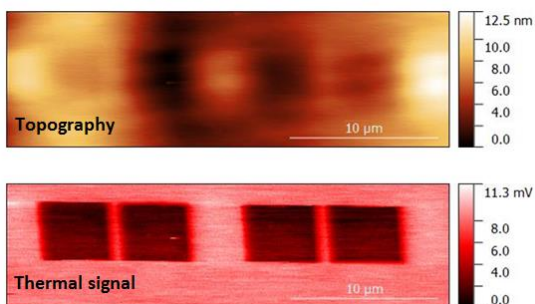


Figure 6 : Topography and Thermal contrast of the Free SThM Calibration Sample from GU obtained using CSI Nano-Observer equipped with a KNT probe @CSI

## Contact details



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