

Acoustic Monitoring of the STM Tunneling Current

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The tunneling current is the only outgoing signal in scanning tunneling microscopy (STM) experiments. The current contains information about electronic states, the transition between these states, and the gap itself, which is formed between the probe and the studied system. Since its invention, the instrumental development reflects our increasing access to the different components which are contributing to the tunneling current. Central in the data analysis is the splitting of the current signal into its frequency components. Respectively, incoming signal are modulated in time and the response in the tunneling current grants the access to the properties of the studied system. For example, in simple STM imaging the current is kept constant through a z-feedback loop, and the response of the DC (or low frequency) current with the lateral motion as regulated by z is displayed.

Here, we use the current signal to address gap noise. In particular, a common problem in our study of molecular systems is the unintentional capture of organic parts by the probe. This can be traced in current noise beyond 100 Hz. Monitoring externally the current response after FFT filtering is possible but also visually distracting. Instead, the human ear does inherently act as a FFT analyzer. We therefore demonstrate an Arduino project to first filter the DC signal out, realize an adjustable band pass filtering, and the conversion into an instantaneous, acoustic signal without distracting the visual supervision of the experiment by the user.

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