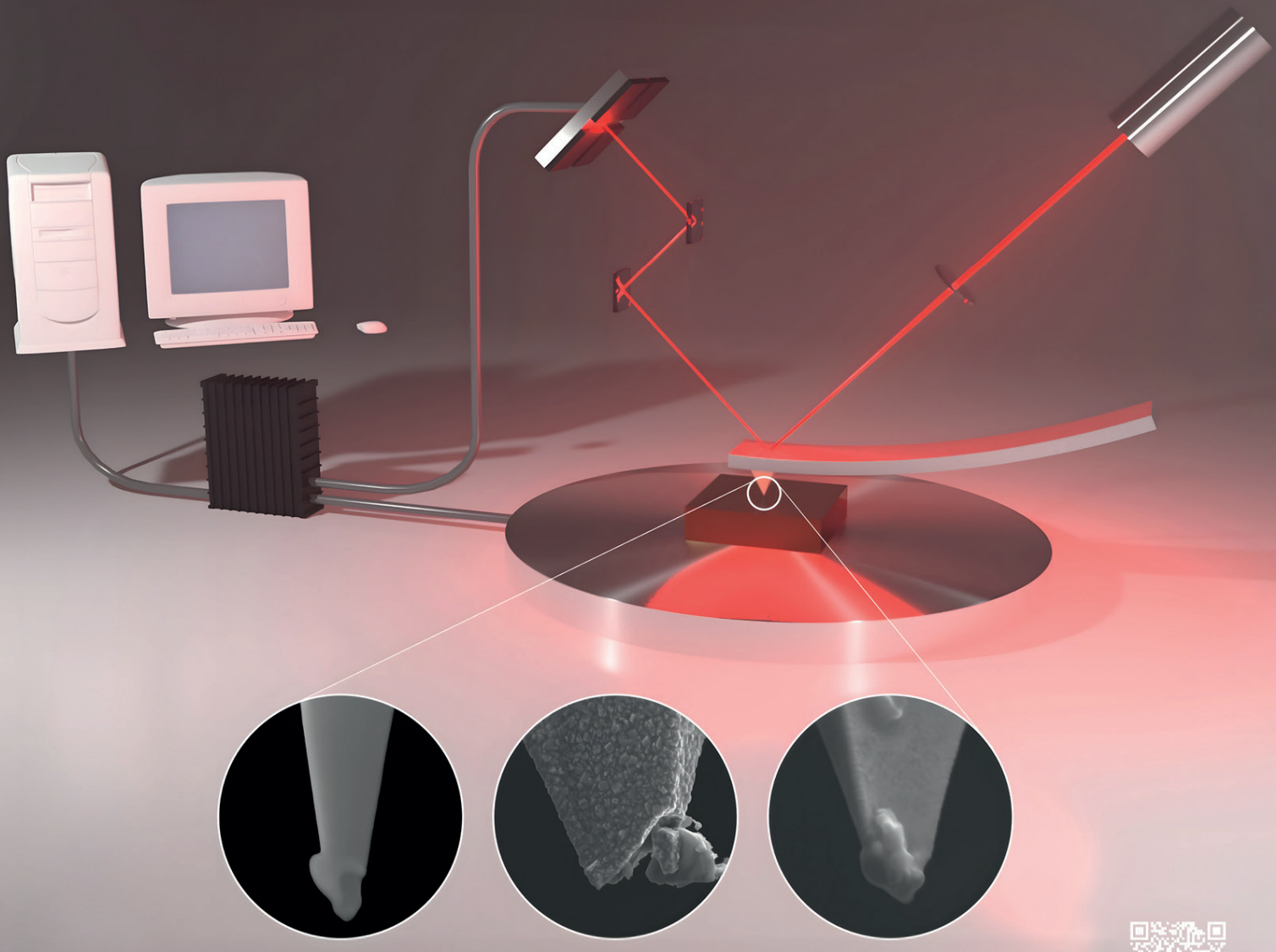
TECHNISCHE HOCHSCHULE DEGGENDORF

IMPROVING THE RELIABILITY OF C-AFM

ZUVERLÄSSIGERE MESSUNGEN FÜR DIE NANOELEKTRONIK.



Weitere Infos

Abstract

Projekttitel/ Project title:

Improving the Reliability of Conductive Atomic Force Microscopy (C-AFM)

Kurztitel/ Short title:

PhD thesis Jonas Weber

Einleitung/ Introduction:

Owing to its exceptional topographical resolution and electrical sensitivity, Conductive Atomic Force Microscopy (C-AFM) has become an essential tool for nanoscale material analysis. However, achieving reproducible data in C-AFM remains a challenge, primarily due to the multitude of factors influencing the stability of the tip-sample contact. Among these, tip degradation stands out as a particularly critical issue. To attain high topographical resolution, C-AFM probes are designed with small tip radii, but this makes them more susceptible to degradation. Such degradation primarily manifests in two forms. Firstly, since C-AFM measurements are commonly performed in contact mode, mechanical abrasion due to lateral frictions. Secondly, exposure to high current densities, an inherent consequence of the small tip radii, can lead to partial or complete melting of the probe's conductive coating. While the issue of mechanical abrasion has been mitigated to some extent by performing C-AFM measurements in intermittent contact mode – a recent advancement in the field – this presentation concentrates on developing strategies to minimize tip degradation caused by high current densities.

Ziel/ Aim:

The primary goal is to present a robust solution that effectively shields C-AFM probes from damage induced by high current densities. Overall, this presentation shall contribute to the evolution of the C AFM technique by enhancing its reliability and therewith ensuring more consistent and dependable results in nanoscale material analysis.

Methode/ Method:

To ascertain the current status quo, an in-depth analysis of the degradation dynamics of Pt/Ir-coated Si probes, currently predominant in C-AFM applications, is conducted.
Readily available alternatives like solid Pt probes, or software-based current limitation were evaluated.
New methods for true current limitation in C-AFM were developed and tested.

Ergebnis/ Result:

True current limitation has been achieved by designing an innovative C-AFM sample holder featuring an integrated CMOS transistor.

Projektbeteiligte/ Project participants:

University of Barcelona

Projektpartner/ Project partners:

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Gefördert durch/ Funded by:

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Logos/ Logos:

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insgesamt maximal 450 Wörter/ limit of 450 words in total