

Charging behavior of the calcite (100) surface investigated by KPFM

M. Mirkowska^{1,2}, M. Kratzer², C. Teichert² and H. Flachberger¹

1: Chair of Mineral Processing, Department of Mineral Resources and Petroleum Engineering, Montanuniversität Leoben, Franz-Josef Straße 18, 8700 Leoben, Austria
2: Institute of Physics, Montanuniversität Leoben, Franz-Josef Straße 18, 8700 Leoben, Austria

Detailed knowledge about the contact charging behavior of dielectric materials is of great interest for technological applications like tribocharging separation of mineral particles [1,2]. The underlying mechanisms are still not well understood. The charging of calcite single crystal surfaces upon contact with an Atomic Force Microscope tip has been investigated using Kelvin Probe Force Microscopy [3-6].

The resulting surface charge depends on both the type of charging (static charging, rubbing), and the value of the initial surface potential. A charge decay, within several tens of hours, has been observed. Increasing the sample temperature accelerated this charge decay process. Sequential charging of the same area with opposite sign could be performed, showing that the preceding charging does not alter the charging behavior.

Interestingly, so called “specific places” with different charging behavior compared to the surrounding matrix could be identified. These areas are supposed to be related to defects on the dielectric surface.

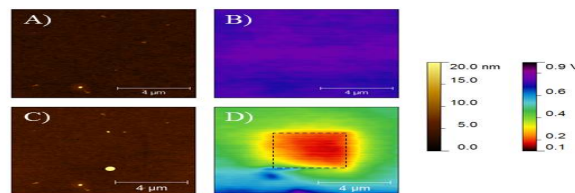


Figure 1: Topography (A) and corresponding surface potential (B) prior to charging and after charging (C, D). Charging was performed by rubbing the TiN tip in contact mode over a $4 \times 4 \mu\text{m}^2$ area. The charged area can be easily recognized in the surface potential image D).

References

- [1] M.J. Pearse, M.I. Pope, *Powder Technol.* **14** (1976) 7
- [2] B.A. Kwetkus, *Part. Sci. Technol.* **16** (1998) 55
- [3] M. Nonnenmacher, M.P. O’Boyle, H.K. Wickramasinghe, *Appl. Phys. Lett.* **58** (1991) 2921
- [4] *Kelvin Probe Force Microscopy*. S. Sadewasser and Th. Glathzel (Eds.), Springer-Verlag Berlin, Heidelberg (2011)
- [5] B.D. Terris, J.E. Stern, D. Rugar, and H.J. Mamin, *Phys. Rev. Lett.* **63** (1989) 2669
- [6] Y.S. Zhou, Y. Liu, G. Zhu, Z.-H. Lin, C. Pan, Q. Jing, and Z.L. Wang, *Nano Lett.* **13** (2013) 2771