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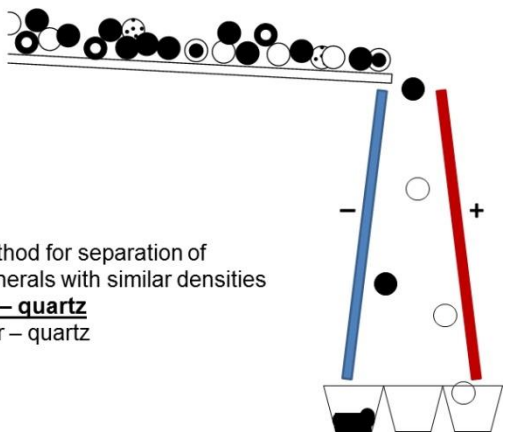
Triboelectric charge behavior studied by Kelvin Probe Force Microscopy

Charge transfer between two solids is complex. To obtain a better understanding of the underlying mechanisms of this phenomenon, it is necessary to study it in detail at micro- and nanoscale.

Triboelectrostatic Separation



Only dry method for separation of dielectric minerals with similar densities

- **calcite – quartz**
- feldspar – quartz

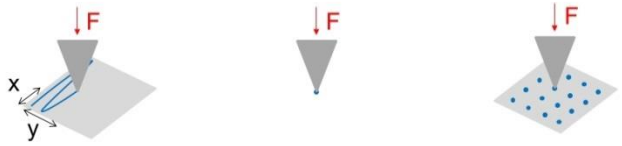
Triboelectric separation is a well-known dry method used to separate non-conductive, non-magnetic minerals with similar densities. This method is based on contact charging. Till date, selection of the process parameters is done on a trial and error bases. Therefore, in order to understand mechanisms of charge transfer during contact, Atomic Force Microscopy (AFM) techniques are employed.

Calcite and quartz single crystals are used as model system, since effective triboelectrostatic separation of those two materials is well known.

Combination of contact mode (for charging) and Kelvin Probe Force Microscopy (KPFM) (for recording of surface potential) allows us to observe the influence of parameters such as type of contact, contact force, temperature, humidity , etc., on the magnitude of the introduced charge.

Rubbing **Static charging** **Matrix of static charging**

Methods of insulator charging

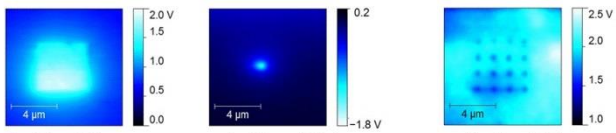


The AFM tip is dragged with or without applied bias across a chosen surface area with defined force and speed.

The AFM tip with applied bias is brought into contact at a fix position with a defined force and for defined time.

The AFM tip without applied bias is brought into a contact at a defined set of points with a defined force and for defined time on a chosen surface area.

Surface potential after charging



tip bias 0 V,
rubbed area 4 x 4 µm²
contact force 0.5 µN
speed of rubbing 1.2 µm/s
number of lines 256

tip bias -10 V
contact force 2 µN
time of contact 30 min

tip bias 0 V
contact force 1 µN
number of points 4 x 4
charged area 4 x 4 µm²

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Forschungsschwerpunkte:

Triboelectrostatic separation of minerals
Contact charging and Electrification
Kelvin Probe Force Microscopy and Atomic Force Microscopy measurements