Building a baked anode material with *PFC*

CIVIL • ENVIRONMENTAL • **MANUFACTURING** • MINING • OIL & GAS • POWER GENERATION

PROJECT DESCRIPTION

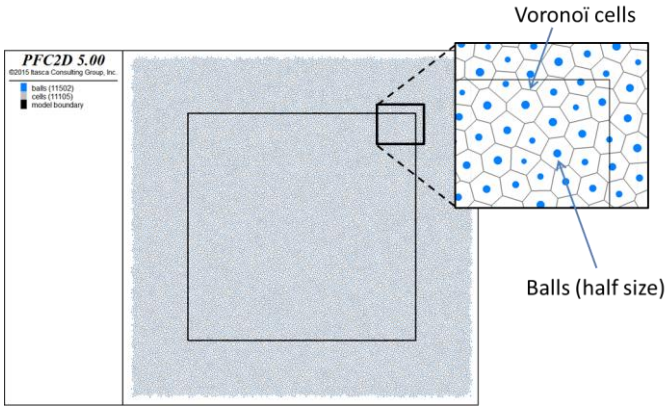
Hydro Primary Metal Technology

Norway

PFC2D™

A baked anode is made of a complex material, obtained by mixing and baking different petrol coke grains, with different size distributions, with a pitch. **Hydro PMT** needs to study how cracks propagate in such a material – both within and between grains. Representing properly the non-spherical grain shapes, as well as the porosity, both between grains and within the coke grains, are therefore prerequisites.

Reproducing the true experimental process would be way too cumbersome. How to obtain a representative geometry without simulating this process?



A Voronoï tessellation of balls centroids (set of polygons that pave the domain)

ITASCA'S ROLE

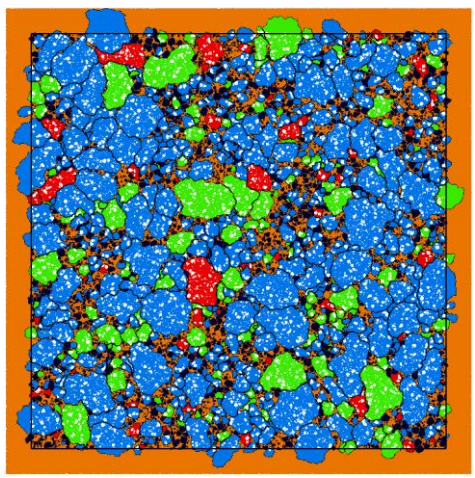
Develop an environment using a two-dimensional version of *PFC* to build a geometric description of an anode. The anode volume is represented using a Bonded-Particle Modeling (BPM) approach. The complex environment must be able to:

1. Create irregularly shaped grains
2. Reproduce a desired grain size distribution for each material
3. Reproduce a desired volume fraction for each material and void content
4. Reproduce a desired porosity inside grains
5. Generate different types of geometries:
    a) Randomly distributed grains
    b) Grains grouped in different ways to simulate segregation

PROJECT RESULTS

A new methodology creates a representative anode material geometry.

1. Start with a Voronoï tessellation of the volume
2. Reconstruct the anode geometry:
    - Grow grains according to the desired size distribution and volume fraction for each material
    - Grow voids in remaining cells (the reminder constitutes the matrix binder phase)
    - Add pores inside grains
3. Overlay geometry information onto the BPM matrix



Final representation of the baked anode including voids in black and porosity in white

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