X-ray Computed Tomography (XCT) for characterization of particulate materials heterogeneity: Embrace heterogeneity – create value with separation

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Value created by mineral beneficiation processes relies on physical separation (including flotation) of particles containing different grades of metals or minerals of economic interest. The value created is a direct consequence of exploiting heterogeneity as governed by the properties of the natural resource that is processed, most often starting by well-controlled size reduction processes, e.g. blasting, crushing and grinding. These are usually applied in a stepwise fashion before the separation stage exploiting the liberated mineral(s) of economic interest.

While material heterogeneity usually is a property that must be managed (reduced) by mixing and blending to stabilize sampling and optimize extraction processes, it can also be the fundament for creating value by first increasing liberated heterogeneity to allow effective sorting to come into play. To calibrate value-adding physical separation processes it is necessary to be in complete control of material heterogeneity, as part of characterization of the original natural resource. Optimal physical separation is based on relevant sampling, Theory of Sampling (TOS). However, this is currently done with labour intensive processes conducted with highest precision but notably most often only using small sample masses, often leaving accuracy be the wayside. This contribution shows that TOS is a prime factor, as is representative heterogeneity characterization, necessary for optimizing mineral beneficiation processes.

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