Compressed sensing and structure of multicomponent alloys

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Compressed sensing is a signal processing technique for efficiently acquiring and reconstructing a signal, by finding solutions to underdetermined linear systems. This takes advantage of the signal's sparseness or compressibility in some domain, allowing the entire signal to be determined from relatively few measurements. This technique is applied to X-ray studies of metallic alloy structure. Using optimized wavelet transforms which are developed within Polydisperse Hard Sphere approximation we filter experimental noises and increase the precision of the experimental data which allows to detect a lot of subtle effects inaccessible for standard experimental studies

Simulation of metallic alloy structure during melting process

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During the recent decade the Polydisperse Hard Sphere approximation was developed and intensively investigated. Here, we are implementing new technique for modeling of structural transformation of atomic distribution in binary alloys in the temperature ranges right above their melting points. Controlling the dispersion factor of each component and the composition of the alloy we calculate partial correlation function (e.g. Structure Factors and Pair Correlation Functions) and receive series of snapshots for each set of control parameters. Comparing the temperature dependencies of real system with the one we calculate within Polydisperse Hard Sphere approximation we may reproduce the dependency of dispersion factors (and other parameters if the model is multivariate) on temperature for the reference system in a whole range of interested states. We have performed these calculations for a set of binary alloys and found the fact there is some classes of the alloys obeys similar rules so the calculation made for some reference metal may be expanded to the whole class of the alloys.