EUROPEAN SYNCHROTRON RADIATION FACILITY
INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

Experiment Report Form

	Experiment title: x ray microdiffraction mapping of underdoped La2CuO4+y.	**Experiment number**:
Beamline:	**Date of experiment**: from: 10/10/2010 to: 13/10/2010	**Date of report**: 17/11/2011
Shifts:	**Local contact(s)**: Manfred Burghammer	*Received at ESRF:*

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Report: It is well known that the microstructures of the transition-metal oxides, including the high-transition-temperature (high-T_c) copper oxide superconductors, are complex. This is particularly so when there are oxygen interstitials or vacancies which influence the bulk properties. For example, the oxygen interstitials in the spacer layers separating the superconducting CuO_2 planes undergo ordering phenomena in $Sr_2O_{1+y}CuO_2$, $YBa_2Cu_3O_{6+y}$ and La_2CuO_{4+y} that induce enhancements in the transition temperatures with no changes in hole concentrations. It is also known that complex systems often have a scale-invariant structural organization, but hitherto none had been found in high-T_c materials. Here [1]we report that the ordering of oxygen interstitials in the La_2O_{2+y} spacer layers of La_2CuO_{4+y} high-T_c superconductors is characterized by a fractal distribution up to a maximum limiting size of 400 μm. Intriguingly, these fractal distributions of dopants seem to enhance superconductivity at high temperature.

[1] M. Fratini, N. Poccia, A. Ricci, G. Campi, M. Burghammer, G. Aeppli, and A. Bianconi, Nature **466**, 841 (2010), ISSN 0028-0836, URL http://dx.doi.org/10.1038/nature09260.