ESRF	**Experiment title:** Critical order parameter relaxation near the Fe_3Al surface	**Experiment number:** SI-207
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Shifts: 13	**Local contact(s):** Christoph Sutter	*Received at ESRF:*

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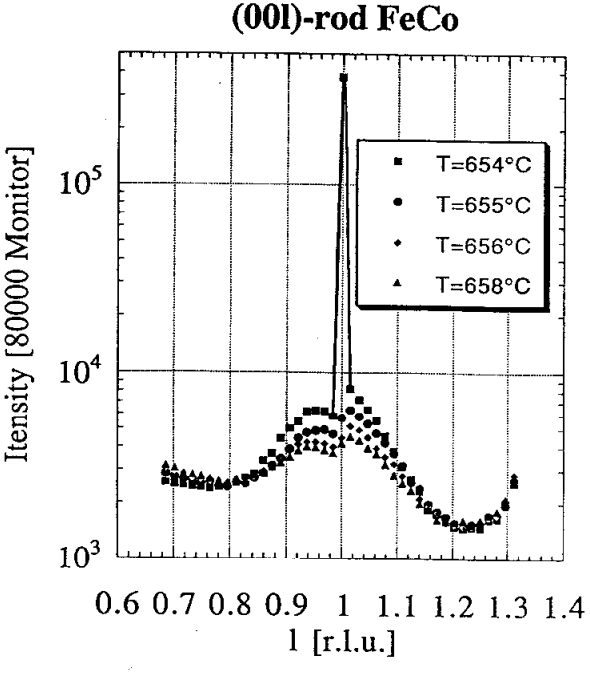
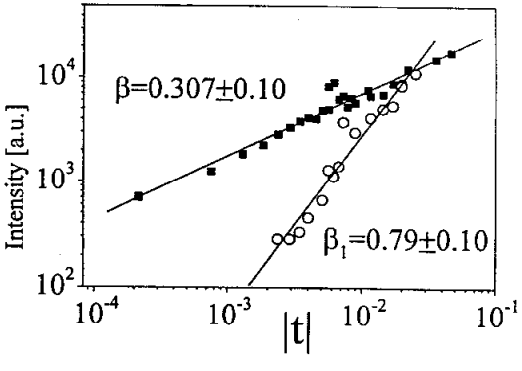
Report:

We performed an x-ray scattering study of the interplay between surface segregation and surface critical phenomena in the binary alloy FeCo. FeCo was used instead of FeAI, because it could be grown epitaxially with a much better crystal and surface quality. In a previous experiment at ID3 it turned out that the weak one-electron scattering associated with ordering phenomena in FeCo could readily be observed with sufficient counting rate even without anomalous enhancement effects at the Fe-K edge. In this study we used a transportable UHV-chamber which maintained a vacuum better than 10^{-9}mbar and allowed to accurately control the sample temperature with an uncertainty of ± 0.1K. We performed detailed L-scans across the (001) reciprocal lattice point around the bulk critical temperature which has been measured simultaneously. The left figure below shows typical L-scans along the (00L) crystal truncation rod; below the critical ordering temperature of the bulk a narrow gaussian component associated with bulk order is visible together with a very broad **component associated with a surface-modified order.**

Most interestingly, this broad component is still observable when the bulk is disordered, thus giving direct evidence for surface order in the presence of a disordered bulk. The data are well described by a model in which an oscillating and towards the bulk exponential decaying segregation profile occurs at the surface. The temperature behaviour of the order parameter of the bulk film, at a near surface region of about 150 Å thickness, and at the very surface have been determined independently with high accuracy in a dynamical range of three orders of magnitude in temperature. It turned out that the bulk critical behavior obeys a power law with the well known bulk exponent β=0.3, while the order within the near surface region implies β_1=0.8 (right figure), as it is known from other critical systems [1]. As a novel surface phenomenon, we find that the order parameter at the very surface is affected by surface segregation and shows a temperature dependence which is only understood when a socalled surface field is introduced. This study gives thus a first experimental evidence for a critical surface film floating on a disordered bulk and for the presence of surface fields at binary alloys [2].





[1] L. Mailänder et al., Phys. Rev. Lett. **64**, 2527 (1990)

[2] S. Krimmel et al., submitted