Coherent Synchrotron Edge Radiation and Applications at ANKA

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Synchrotron Light Source ANKA
Karlsruhe Research Center, Germany
Where is ANKA?
The facility
Magnetic profile at a dipole of ANKA

Spatial distribution from the edge at 3m from the source

\[ \lambda = 100 \, \mu m \]
Edge radiation at ANKA-IR

in the visible at 2.5 GeV

in the mid-IR: 700-1400 cm\(^{-1}\) at 2.5 GeV
Coherent Synchrotron Radiation: gain up to $10^4$ (Si bolometer)
Coherent “low α” mode at ANKA

- Single user mode
  - $E = 1.3$ GeV
  - initial current intensity $\sim 50-70$ mA
  - lifetime $\sim 15$ hours
  - effective bunch length $< 1$ ps
  - spectral range $\sim 5 - 50$ cm$^{-1}$

- 6 blocks of 2 days per year
Ellipsometry principle

Elliptically polarized light

determined by:
1. Relative phase shift, $\Delta = \delta_p - \delta_s$
2. Relative attenuation, $\tan \Psi = |I_p|/|I_s|$

From:
$$I(A_i)/I_0\ a = 1 + \alpha \sin(2A_i) + \beta \cos(2A_i)$$

Obtain:
$$\varepsilon(\omega, \alpha, \beta, \phi, \mathbf{P}) = \varepsilon_1(\omega) + i \varepsilon_2(\omega)$$
Soft mode spectroscopy: experimental studies of structural phase transitions

1st ellipsometric measurements using CESR (July 2005)
C. Bernhard, A. Boris, Y.-L. Mathis, A.-S. Müller
Reduced-minus-oxydized FTIR difference spectrum of Cytochrome c in solution
Far infrared and THz analysis of biological metal sites in proteins and related model

Red-minus-ox and ox-minus-red FTIR difference spectra of Cytochrome c in solution
Future infrared beamlines

IR 3 (projected)
IR 1 (operational)
IR 2 (under construction)
Summary

Coherent “low \( \alpha \)” mode at ANKA

- Single user mode
  - \( E = 1.3 \text{ GeV} \)
  - initial current intensity \( \sim 50-70 \text{ mA} \)
  - lifetime \( \sim 15 \text{ hours} \)
  - effective bunch length \( < 1 \text{ ps} \)
  - spectral range \( \sim 5 - 50 \text{ cm}^{-1} \)

- 6 blocks of 2 days per year (this will double with IR 2)

Studies are going on to improve the source understanding

First successful experiments on solid \((\text{SrTiO}_3)\) and on protein \((\text{Cytochrome c})\)
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