



Contribution ID: 24

Type: **Plakat // Poster**

## **X- ray absorption spectroscopy analysis of aerosol particles during summer and winter in Krakow, Poland**

*Monday, 8 September 2025 19:00 (20 minutes)*

The XANES technique (SOLARIS ASTRA beamline) has been used to study absorption K-edges of sulphur, chlorine, potassium, iron and zinc of 8 aerosols samples (PM<sub>2.5</sub>) collected in Krakow during summer and winter 2018/2019 and 2020/2021. A set of 17 reference samples (sulphides, sulphates and bisulphates of NH<sub>4</sub>, K, Na, Ca, Zn, Fe and Cu, potassium chloride, potassium carbonate and bicarbonate, potassium nitride) was studied as well. The results show that PM<sub>2.5</sub> XANES spectra at S absorption K-edge have different characteristics in summer and winter. Samples of PM<sub>2.5</sub> collected in summer contain mostly sulphates. On the other hand, spectra from samples collected in winter additionally contain peaks of KHSO<sub>4</sub>, NaHSO<sub>4</sub>, NH<sub>4</sub>HSO<sub>4</sub>, ZnS and sulphur in organic compounds. The Table 1 below shows our XANES results at the K-edge of potassium with the contribution of each compound to potassium in PM<sub>2.5</sub> samples collected in winter. The highest contribution to potassium has KHSO<sub>4</sub>. The contribution is in the range 31-46%. The lower contribution to potassium is observed for KHCO<sub>3</sub> and K<sub>2</sub>SO<sub>4</sub>. The obtained results for potassium K-edge confirm the results from sulphur K-edge, that during winter bisulphates are present in particulate matter.

Acknowledgements: This research project was supported/partly supported by the program “Excellence initiative—research university” for the University of Science and Technology and by SOLARIS project no 232073. Thank you Grzegorz Gazdowicz and Lulu Alluhaibi for the support during the measurements.

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**Session Classification:** Sesja plakatowa

**Track Classification:** Inne // Others