

## Mineralogical cycle of Pb(II) in a sinter plant of iron and steel industry

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One of the main initial technological processes of iron and steel metallurgy is sintering, production of the raw material of pig iron. Dust released during sintering needs to be separated from the flue gas, e.g., by electrofilters for the fine fraction. The extracted dust, still containing a high portion of iron oxides, is normally recirculated to the sintering process as secondary raw material. If recirculated, with time the dust gets enriched in KCl, NaCl, and at some plants, contains also elevated lead concentration. The speciation of the latter is important from technological, economical [1], and environmental aspects.

The aim of our research is the reconstruction of the mineralogical path of lead in a sintering plant applying recirculation. We studied original dust samples collected from the technological chain and laboratory samples generated by water solution tests of the original samples. XRPD and ATEM were the key techniques of phase determination.

Lead circulates in divalent form in the system. In the primary, high temperature dust it forms chlorides, well known from lead smelters' dust: cotunnite ( $\text{PbCl}_2$ ) and chalcocollite ( $\text{KPb}_2\text{Cl}_5$ ). On cooling the relative humidity of the gas is increasing and in the final, electrofilter-based filtering stage chloride-hydroxides, penfieldite ( $\text{Pb}_2\text{Cl}_3(\text{OH})$ ) and laurionite ( $\text{PbCl}(\text{OH})$ ), reported also earlier [2], become dominant in the separated powder. On recirculation that powder is mixed to the primary raw materials in a wet medium. Our solution tests show, in agreement with [3], that after that technological step lead is present as hydrocerussite ( $\text{Pb}_3[\text{CO}_3]_2(\text{OH})_2$ ).

During sintering ( $> 1200^\circ\text{C}$ ) hydrocerussite dissociates [4] and transforms into different lead oxides, ready to react with the elevated Cl concentration of the flue gas, closing the mineralogical circle. The variable mineralogy makes it complicated to extract lead from the circle either for economical or for environmental reasons.

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[1] Tang et al. (2020), *Miner. Eng.* **148**, 106183. [2] Kantor et al. (2019), *J. Pol. Min. Eng. Soc.* **21**, 47-52. [3] Sammut et al. (2010), *Chemosphere* **78**, 445-450. [4] Flemming et al. (1984), *Thermochim. Acta* **81**, 1-8.