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INVESTIGATION OF THE INFRARED EMISSION OF MOLTEN ALUMINATE- AND SILICATE SLAGS USING THE FOURIER-TRANSFORM-SPECTROSCOPY

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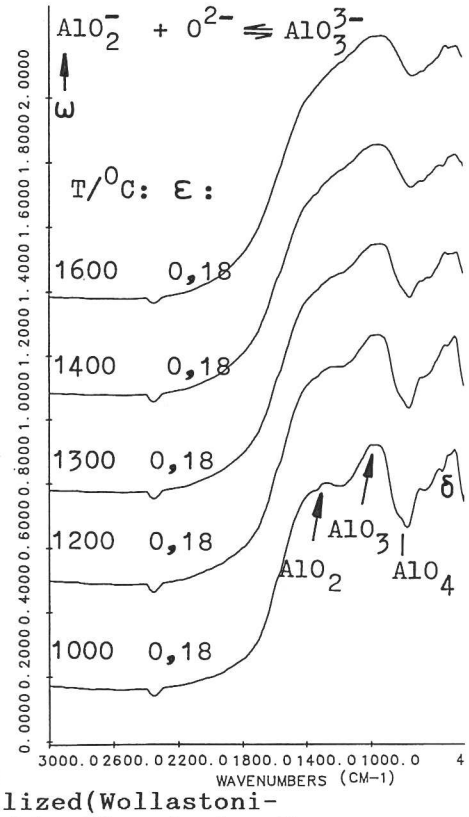
The IR-emission of liquid and solid slags (1000 up to 1600°C) reflects the structure of the slags.The stretching-and deformation-vibration of the molecular species in the slag take place in the near and middle IR between 5000 and 400 cm^{-1} (wave length 2-25µm). We had to take care of main problems during the construction of our radiation cell: First,the slag film must not be too thick in order to prevent absorption and reemission of the IR-photons;this would result in a broadering of the IR-bands and complicate the interpretation of the spectra.Second, we had to avoid the use of a slag cruicible because this would emit perturbating IR-radiation by itself.Therefore we use a wire net (0.12mm wire diameter) made of Pt70Rh30 which is heated electrically.The IR-radiation emitted by the net is very small (emission coefficient $\epsilon_{Pt}=0.04\pm0.01=$ constant/1600°C,7000-400cm^{-1}) and it takes only one fifth of of the area of a comparable sheet.In the liquid state the slags build thin films (thickness about 0.2mm).The used Fourier-Transform-technique offers the possibility to examine a large spectra in a short time.Slags of the systems $CaO-Al_2O_3$ (without and with addition of CaF_2,MgO and B_2O_3),CaO-MgO-SiO_2 and CaO-Al_2O_3-SiO_2 are the topics of the structural investigations.The figure shows typical emission spectra of a 66CaO-34Al_2O_3-slag (Mol-%) at different temperatures [$T_{Liq.}$ >1400°C,thickness 0.20mm].In liquid CaO-Al_2O_3-slags the equillibrium $AlO_2^- + O^{2-} <=> AlO_3^{3-}$ is dominant,whilest in solid state the formation of AlO_4^{5-}-units take place with the decrease of temperature.The wavenumber shift of the asymmetrical Si-O-vibrations depends strongly on the Si-O-X(X=Si,Al,Ca,Mg) bonding state (base-acid-indicator in liquid silicate melts).In solid silicates(1000-1200°C) the transformation of the glassy in the crystallized(Wollastonite,Diopside) state (time dependnce) was measured by IR-emission.To obtain the accurate position of the emission maxima and the intensities we carried out curve-fittings by using gaussian functions. The present investigations deal with the solution of gases (H_2O in CaO-Al_2O_3 and H_2O/HF in CaF_2-CaO-Al_2O_3,method in [1])in the slags.



[1] G.Leekes,N.Nowack,F.Schlegelmilch: steel research 9 (1988),406