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# Sulphur Control in Ni-Based Superalloy Production

## Motivation

- Sulphur is a common impurity in raw materials and detrimental for the mechanical properties of nickel-based superalloys
- The common method of desulphurization by NiCa and NiMg addition in vacuum induction melting is limited by several factors
- Electroslag remelting is known to remove sulphur from iron- and nickel-based alloys
- A further optimization of the efficiency of this process might be worthwhile

## Methods



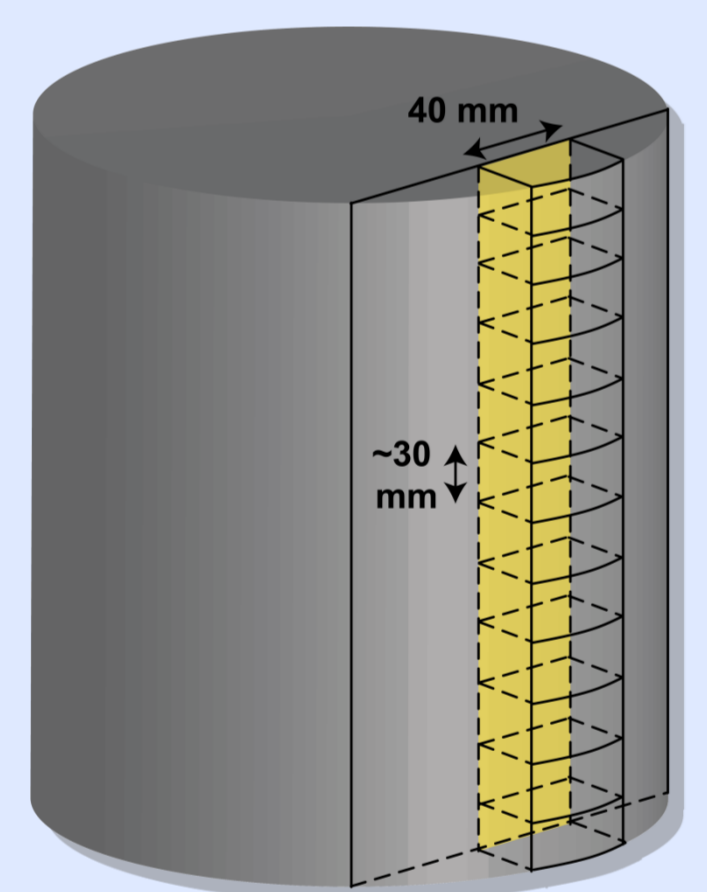
Preparation of S-containing electrodes by vacuum induction melting



Electroslag remelting under different  $\text{CaF}_2$ -based fluxes containing  $\text{CaO}$ ,  $\text{Ca}$  or  $\text{CeO}_2$  \*)



Sampling and analysis of the slag skin and the slag cap



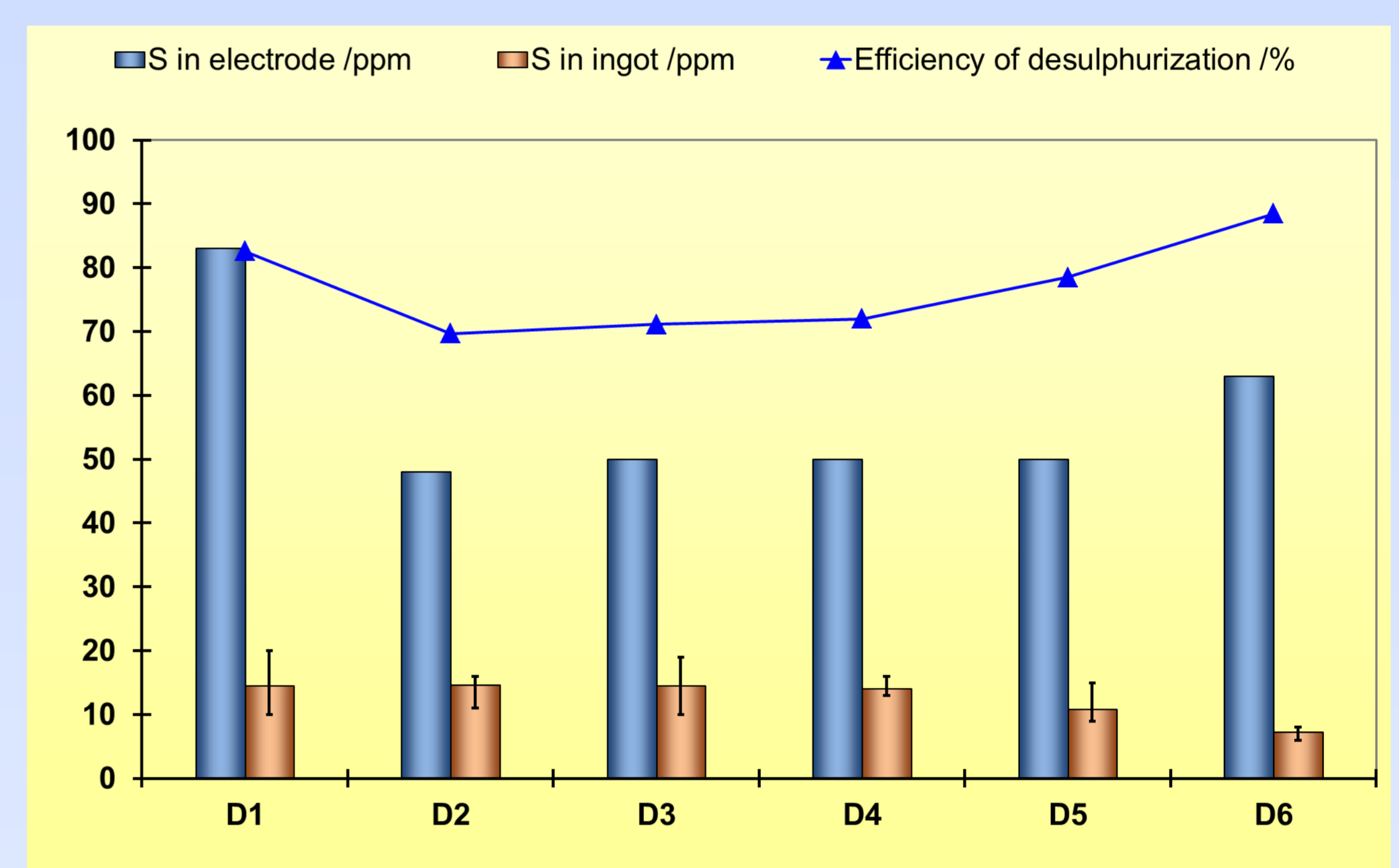
Sampling and analysis of the metal

### \*)Nominal composition of the utilized fluxes:

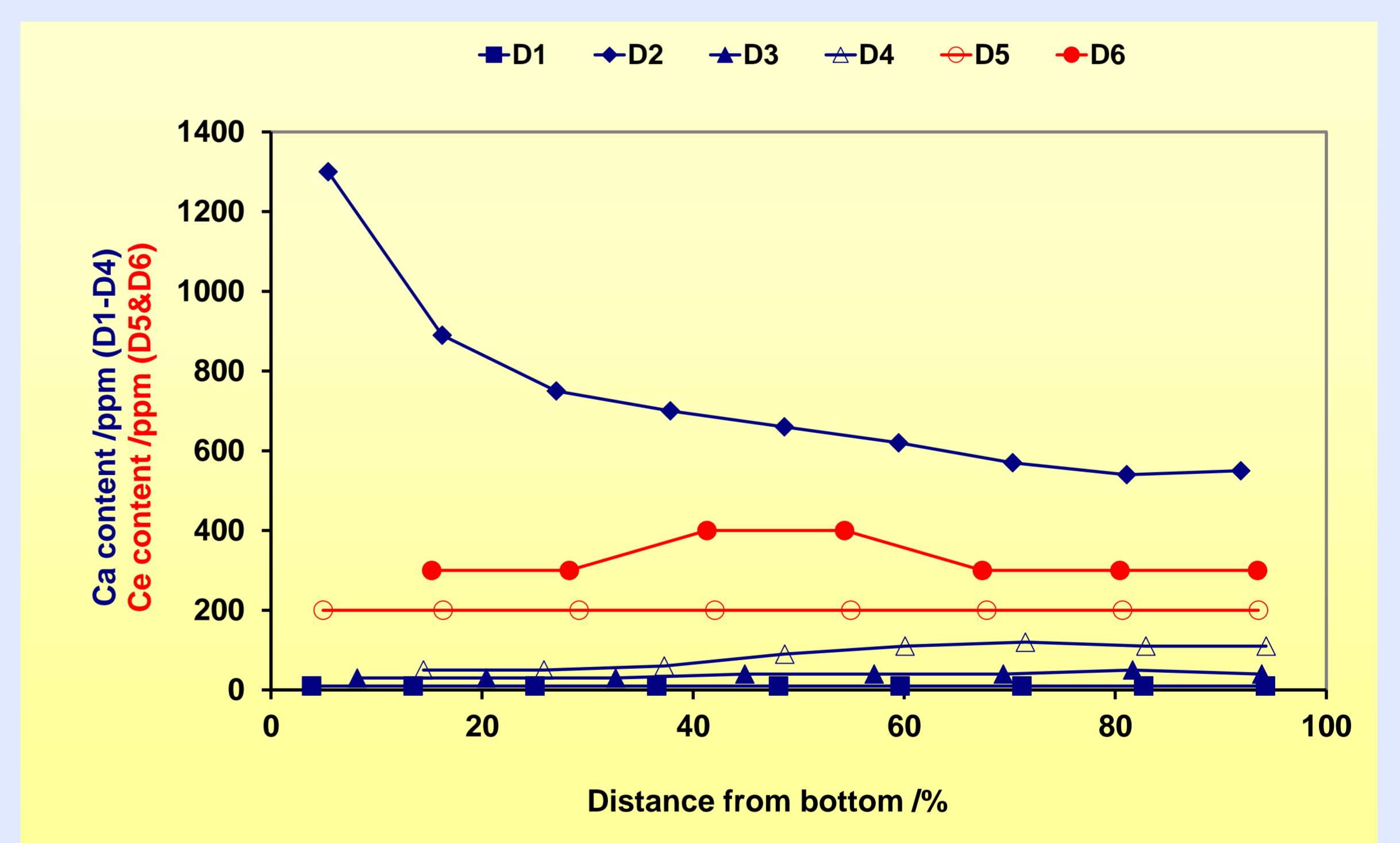
Trial	$\text{CaF}_2$ / wt.-%	$\text{CaO}$ / wt.-%	$\text{Ca}$ / wt.-%	$\text{CeO}_2$ / wt.-%
D1	80	20	-	-
D2	95	-	5	-
D3	79,6	19,9	0,5	-
D4	78,4	19,6	2	-
D5	76	19	-	5
D6	64	16	-	20

## Results

**$\text{CaF}_2$ - $\text{CaO}$ - $\text{CeO}_2$  is most efficient**  
→ sulphur contents below 10 ppm:



**Significant pickup of the desulphurization agents by the metal:**



## Outlook

- Further investigations will be carried out to identify the limiting factor of the desulphurization by metallic calcium
- The form of cerium in the metal will be determined by SEM-EDX
- A possible removal of excess cerium and calcium by vacuum arc remelting will be investigated
- The activity of the reagents in the fluxes will be optimized by further experiments and thermochemical calculations by means of FactSage 6.2