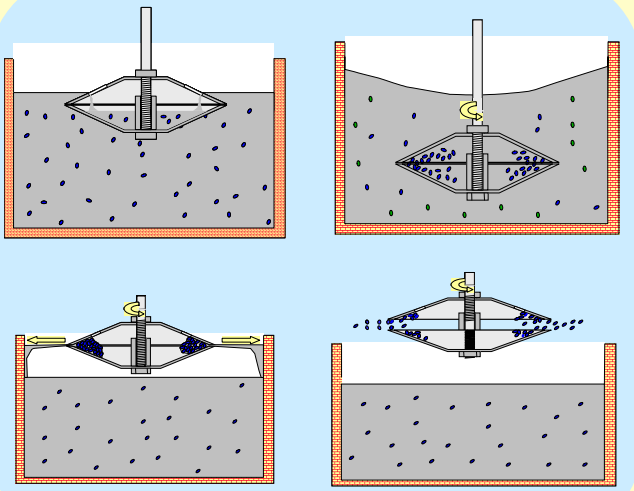
Applications for the Immersed Filter Centrifuge in Molten Metal and Slag Purification



Principle

By the rotational speed and acceleration, the hydrostatic pressure as driving force for filtration, $\Delta p = \rho \cdot g \cdot h$, can be increased in a filter centrifuge, holding back solid particles in a centrifuge vessel while liquid is allowed to pass through. Also, settling speed is accelerated.

The centrifuge head is used to collect solid particles from a melt, either it's surface or from the bulk liquid. The filtration head is provided with two openings, on the bottom or on the top of the conical centrifugal vessel. The particles are drawn inside through the holes, liquid is drawn out through the gap. The particles remain inside the head.

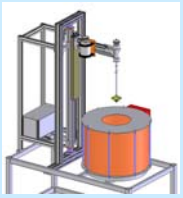
After rotating a certain time, the centrifuge vessel is removed from the melt and spun at high velocities, causing most of the residual liquid in the head to be removed through the gap. The "dry" residue remaining in the vessel can then be removed and the process starts all over again.

Crucial Working Parameters

- **rotational speed n and head radius R: influence on centrifugation factor $\varphi = R\omega^2/g$ (as multiple of grav. acceleration g, $\omega = 2\pi n$)**
- **viscosity η, contact angle Θ: influence on filtration efficiency and settling rate; $\eta, \Theta = f(\text{Temp})$**
- **position of centrifuge in melt: influence on drawing of particles**
- **Angle α of centrifuge head: influence on volume of melt entrapped and outflow characteristics of melt**
- **grain size distribution of input material: coarse material builds up deep bed filter**

Equipment at IME

Aluminium Centrifugation, Lab Centrifuge



Setup Lab Scale Centrifuge

Lab Scale

Crucible volume	3,5 l
Heating power	10 kW
Rot. speed n_{max}	2 000 rpm
Head radius R_{max}	50 mm
$Temp_{max}$	1 200 °C

Pilot Scale Centrifuge

Pilot Scale

Crucible volume	35 l
Heating power	48 kW
Rot. speed n_{max}	2 000 rpm
Head radius R_{max}	150 mm
Temp $_{max}$	1 550 °C

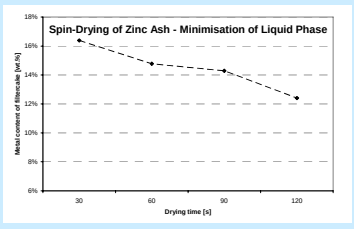
Water Model

Water Model

Water basin volume	125 l
Rot. speed n_{max}	3 000 rpm
Head radius R_{max}	50 mm
Step motor controlled	

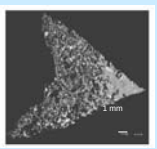
Industrial Applications and Lab/Pilot Scale Investigations

Original use: automatic removal of floating residues from lead refining, industrial scale fully operational in russia and successfully tested in germany



Removal of zinc from ashes and hard zinc from hot dip galvanizing: separation of IM-phases from hard zinc, separation of non-metallic impurities from zinc ash Zn recovery efficiency > 95 %, residual liquid down to 4 %

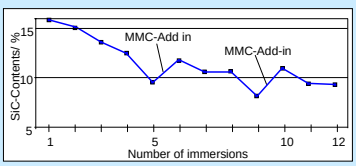
Centrifugation of as-produced aluminium drosses in industrial pilot scale (Centrifuge T3, Italy)



Close up of the intermetallics

Removal of high melting point Iron-Aluminum Manganese intermetallics ($Al_{13}Fe_4$,$Al_6(Mn,Fe)$) from aluminium melts to lower iron contents

Lowering oxide contents of industrial Mg sludges by centrifugation, accumulation of > 60 % oxide in filter cake



Removal of ceramic particles (SiC, Al_2O_3) from used aluminium metal matrix composite melts

Combined remelting of finegrained aluminium scrap and oxide removal from molten salt, residual Al content in filter cake < 1 %

Direct melting and centrifuging of aluminium recycling salt slags (lab scale), recovery of up to 35 % salt, 23 % metal of total input

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