(259) Inclusion seperation studies in continuous casting tundishes.

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INTRODUCTION: Several 1/4 and 1/3 water model studies were conducted in order to determine the controlling factors for the flotation of non-metallic inclusions in continuous casting tundishes . Several common techniques (Ref 1,2) were used for this purpose including a new developed technique (Ref 3) for the simulation of non-metallic inclusions . In plant experiments with radioactive tracers,and steel cleanness results for a 12 ton. tundish of a five strand billet caster were also conducted to validate water model experiments .

EXPERIMENTAL AND RESULTS: After performing flow pattern observations and residence time measurements,experiments with hollow glass microspheres were performed in the 1/4 scale water models . These glass bubbles were injected into the tundish from the submerged nozzle and collected at the exit nozzle in different sampling times . These samples were then analyzed for weight recovery and particle size distribution . A relationship between the time for maximum absorbance(Ta) and the separation of glass bubbles above 80 μm in diameter was observed (Fig 1). According to this relationship,the longer Ta the more the flotation of inclusions will be . Additions of copper sixty four in a five strand,twelve ton. tundish were made in order to validate the data observed in the 1/3 scale water model with respect to residence time diagrams (Fig 2). Similar experiments in tundishes with and without dams were conducted during normal operation in order to know if there is an improvement in the steel cleanness(table 1).
It is concluded that Ta is the most important factor for the separation of non-metallic inclusions .

References 1.- F.Kemeny,et al.,2nd Process Technology Conf.(ISS-AIME),Vol. II,1981,p. 232 . 2.- O.Levenspiel,Chemical Reaction Engineering,2nd edition,1972 . 3.- E.Martinez,M.A.Sc.thesis,University of Toronto,1983 .

Table 1 Steel cleanness.

Inclusion Count (ASTM-E45) / Billet No	Tundish with dams	Tundish with no dams
2	Td2-Fs	Td2-Gs
4	Td1-Fs	Td1-Fs
6	Td2-Fs	Td2-Gs
9	Td2-Fs	Td2-Gs
12	Td1-Fs	Td2-Gs
Last	Td1-Fs	Td2-Gs
Mean	Td1.5-Fs	Td1.83-Gs

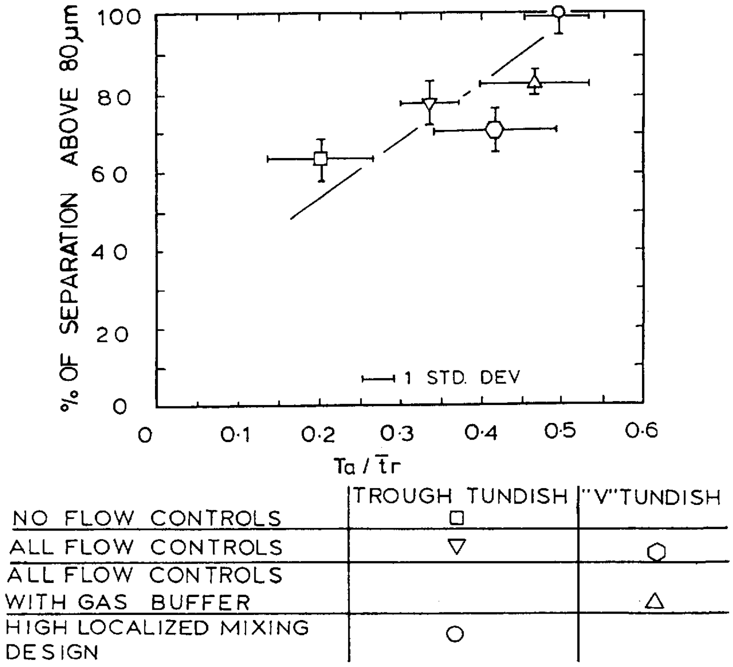

Fig.1 Relation between separation of glass bubbles and Ta/τ̄r (Ta=time for maximum absorbance,τ̄r=mean residence time)

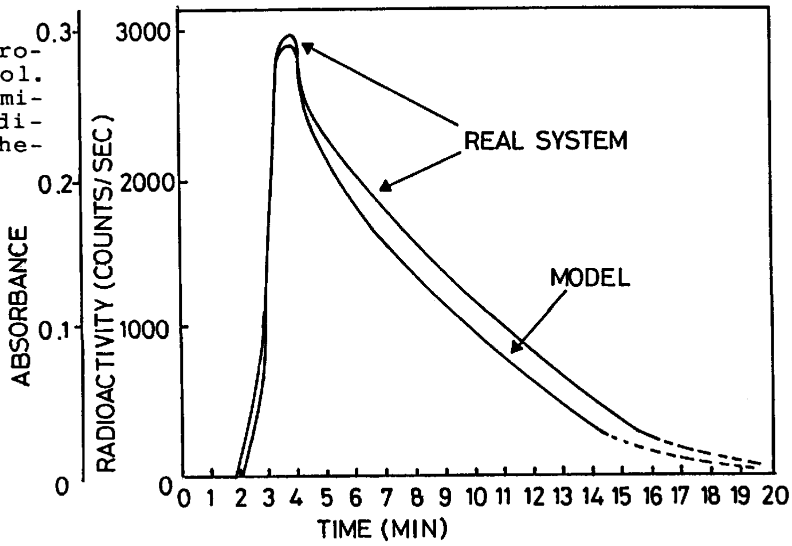

Fig.2 Residence time diagrams for the real system and the model in a tundish with dams