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Removal of ladle & saving the effective heat energy radiated in steel industry

M. S. Dhande

Mechanical Engineering Department, PIET, Nagpur-34.

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ABSTRACT

Tremendous heat energy waste in steel plant through ladle, but nobody think over this issue. A Heat Energy Solidification process are simulated for a continuous casting machine and the constructive shape of the liquid pool is predicted considering at different conditions. Heat energy and Solidification model is described for the C.C. of Steel Slabs. The Model has been established on the basis of the technical conditions of the slab caster in the C.C.

Introduction

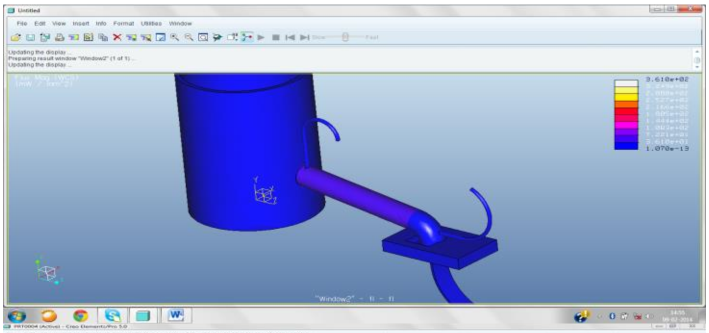
Tremendous heat energy waste in steel plant through ladle, but nobody think over this issue. A Heat Energy Solidification process are simulated for a continuous casting machine and the constructive shape of the liquid pool is predicted considering at different conditions. Heat energy and Solidification model is described for the C.C. of Steel Slabs. The Model has been established on the basis of the technical conditions of the slab caster in the C.C. unit of Bhilai Steel Plant, C.G. India. This model involves 3-dimentional transient energy equation. The governing equation was solved using control volume method and ansys simulation process. The boundary condition of the mold, water spray cooling and air cooling region have been defined. The mathematical model it is able to invent the shell thickness, temperature distribution in the mold and shell, interfacial gap between shell and mold.

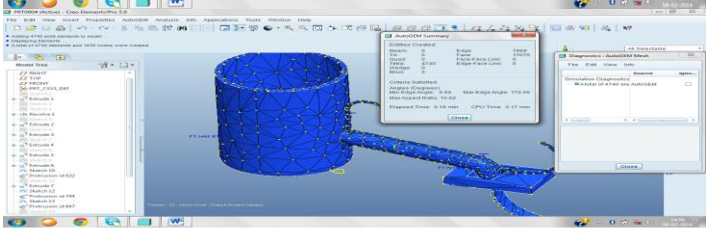
Input data for experimental condition & Result:

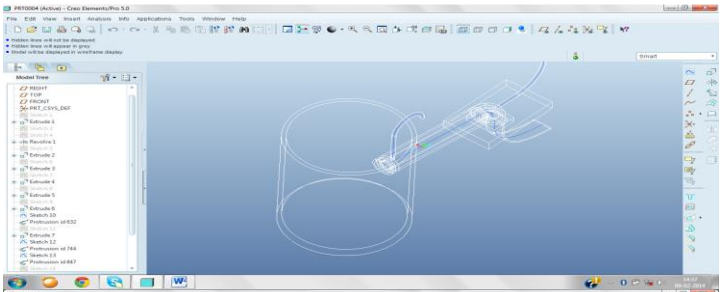
T_1- Ambient Temperature, T_2-air inlet blower, T_3- Inlet of blow plate,

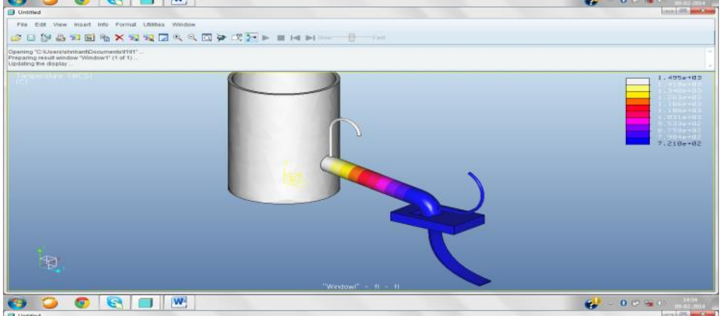
T_4- Center of blow plate, T_5- Outlet of blow plate, T_6- Outlet of duct Air flow rate (manometer) -10m/sec

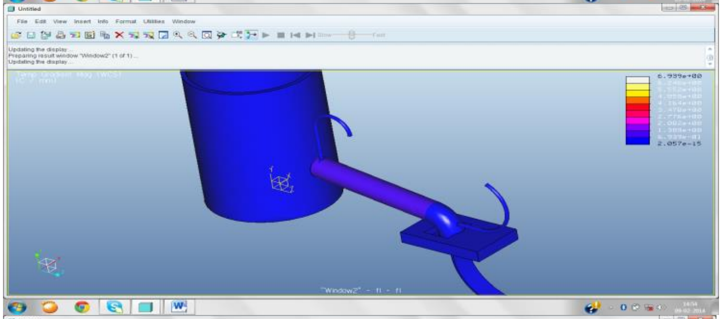
Result:

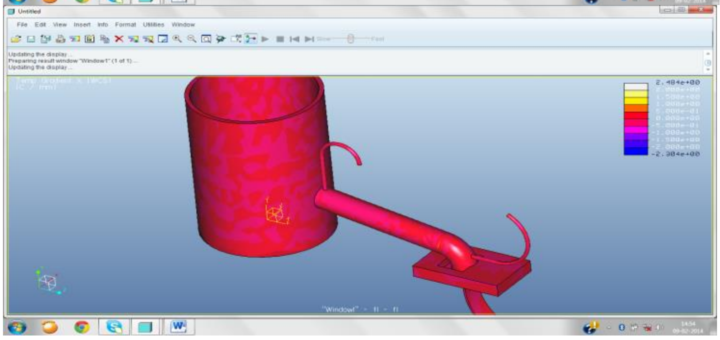










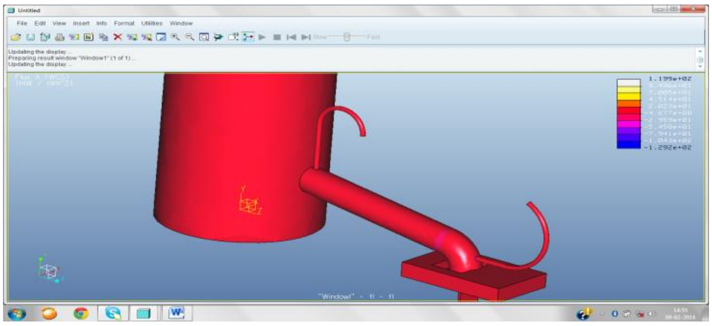


Tele:

E-mail addresses: mahendra.shivaji@gmail.com

Date	**Material**		**Melting Temp °c**		**Melting Time(min)**		
03/04/2013	Lead		143 °c		5 min. (7:07 to 7:12)		
Plate size	Turn	T_1 °c	T_2 °c	T_3 °c	T_4 °c	T_5 °c	T_6 °c
600mm*24mm*5mm	1	34.4	35.2	3	31.6	33.5	32.9
	2	35.3	35.4	14.7	31.2	33.3	33.8
	3	35.8	35.9	27.1	32.7	33.9	34.8
	4	36.1	36.1	30.2	33.6	34.4	35
	5	36.3	36.2	31.8	34.4	34.8	35.4
	6	36.5	36.6	33.7	35.2	35.3	35.6
	7	36.9	37.2	35.2	36	35.7	36.2
	8	37.1	37.4	35.7	36.4	36	36.2
	9	37.1	37.2	36	36.5	36	36.3
	10	37.2	37.6	36.4	36.9	36.2	36.6
	11	37.3	37.6	36.7	37	36.3	36.5
	12	37.4	37.6	36.9	37.3	36.5	36.8
Date	**Material**		**Melting Temp °c**		**Melting Time(min)**		
03/04/2013	Lead		143 °c		5 min. (7:35 to 7:40)		
Plate size	Turn	T_1 °c	T_2 °c	T_3 °c	T_4 °c	T_5 °c	T_6 °c
600mm*24mm*5mm	1	35	36.6	10	24.6	30.7	33.5
	2	35.7	36.6	15.3	29.6	32.1	34.3
	3	36.2	36.8	21.4	30.8	32.7	34.5
	4	36.4	36.7	25	29.6	34.6	35.5
	5	37.1	37.4	31.7	34.6	35	35.7
	6	37.2	36.7	32.1	35.2	35.2	35.9
	7	37.3	37.5	33.8	35.4	35.1	36.2
	8	37.5	37.9	34.7	35.9	35.4	36.4
	9	37.6	37.9	35.2	36.2	35.6	36.6
	10	37.8	38.1	35.6	36.6	35.4	36.8
	11	37.8	38.2	36	36.8	36	36.9
	12	37.9	38.2	36.2	37	36.2	37

Date	**Material**		**Melting Temp °c**		**Melting Time(min)**		
03/04/2013	Lead		143 °c		5 min. (8:10 to 8:15)		
Plate size	Turn	T_1 °c	T_2 °c	T_3 °c	T_4 °c	T_5 °c	T_6 °c
600mm*24mm*5mm	1	35.2	37.1	13	29.9	33	32.7
	2	36.3	37.1	12	29.3	32	33.2
	3	36.6	37	0.4	29.5	28.9	33.9
	4	36.8	37	12.4	30.2	32.3	34
	5	36.9	37.2	21.2	30.7	32.4	34.6
	6	37.3	37.7	23.5	26.6	33.3	35.3
	7	37.8	37.9	29.2	32.9	33.9	37.8
	8	38.0	37.7	28.3	33.6	34.4	33.6
	9	38.0	37.5	30.6	31.6	36.7	35.6
	10	37.9	37.6	31.8	28.1	34.9	35.6
	11	37.8	37.6	32	34.9	36.1	35.8
	12	37.9	37.7	35.4	35.3	35.4	36.8



Calculations :

Therefore for calculation purpose need only dry coal. For April 2002 month dry coal consumption m_f = 280316 x 10^3/30 days = 389327.78kg/h

Therefore input heat energy supplied Q = m_f x CV

Q = 389327.78 kg/h x 30400kj/kg

Q(i/p) = 3287656.8 kj/sec or kw

Adding output =$Q_{conduction}$ + $Q_{radiation}$ + $Q_{convection}$

$QTotal_{(o/p)}$ = 3114856.2

Efficiency of Steel Plant =Output/input=0.9474 (or) 94.7439%

%age error =(Input – Output) x 100/Output = 5.5476262%

Conclusion: In Energy Loss -

* Coal saving.
* Removal of ladle.
* Near about steel available in half cost.
* Alternative source of heat energy through steel plant.
* It's directly help to construction industry
* The cost of building almost less 33 %

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