Abstract- foundry facing serious shortage of foundry sand.

Abstract- In this study, generate compact alternatives for foundry sandreclamation process using suitable fluidised bed and heating unit. a fluidisedbed combustor for foundry sand reclamation using specially arranged anddesigned system for better thermal reclamation process then mechanical reclamationprocess; the influence of selection of dimension of fluidised bed structure, specially design and selected heating unit as like a furnace heating techniquesalso suitable insulation selection and thickness calculation for user safetypurpose and suitable nozzle selection and design of nozzle for sand bubblingpurpose with the help of sand bubbling simultaneous heating of sand take place, nozzle design in such a way that sand does not go inside the nozzle duringworking process. Keywords- sand reclamation unit types, mechanicalreclamation, thermal reclamation, structure design/selection, nozzleselection/design, heating coil, insulation etc. IntroductionFoundrysand reclamation In foundry technology, the maincomponent for making multi purposed core and moulds is silica sand butnow-a-days we are having problems for getting sand sources for future foundryproduct. Today foundry facing serious shortage of foundrysand. The used sand comes with toxic effects that are harmful for soil as wellas air and underground water; hence foundry sand reclamation process isessential.

Reclamation offers replacement of fresh sand consumption in foundryuse by recovered sand. Reclaimed sand is also economical than the new sandconsidering cost, transport cost etc. Thereare main two types of reclamation process, 1) Mechanical reclamation2) Thermal sand reclamation In mechanical attrition reclamation process; vibration, rubbing

etc of sand takes place so that this process fails to removeall binder from the used sand. New sand addition is necessary for further usein foundry mould and core production.

Thermalreclamation is the process in which foundry used sand is heated to temperatureof about 600-8500C. This temperature is obtained in speciallydesigned furnace. This process is highly effective than mechanical reclamationfor removing the binders from foundry used sand. Various sections are involvedin this process such as Lump breaker, Pneumatic lines for transporting breakedsand, fluidized bed, sand cooling system etc. In fluidized bed combustor themain source for combustion is gas but for small scale thermal reclamation setupheating coil is alternative for gas.

Now-a-daysvarious capacity thermal reclamation systems are available. In most casescapacity of thermal reclamation system is 1 ton to 10 ton. Some, 250 kgcapacity unit are also available. They are specially designed for large andmedium size foundry unit. fluidised bed combustion unit size is also large forabove capacity. Generally they use gas combustion unit for sand reclamation. Ifthe size of the reclamation unit is small than there are number of energysources are available. The selection of energy source is based on suitability, economy etc.

Some energy sources like LPG, heating coil etc. give better77results. Needto develop new product within a short time, has given rise to new processeslike rapid prototyping. There is a need of small capacity sand reclamationsystem.

Large number of research paper are available for large capacity thermalreclamation system but it is difficult task to design, analysis and

testing ofsmall size capacity foundry sand fluidised bed combustor. To overcome thisproblem it is required to analyse, design and develop new fluidised bedcombustor system which may handle very small capacity of sand. Fig. 1. 1 Sand reclamation 2.

Literature review In the view of current research area variousresearch papers and journals are referred for understanding sand reclamationprocess and fluidized bed system. Some of papers and journals are arranged areas follows (Holtzer et al., 2003)1 studied the Reclamationof foundry mould; core sand is possible by using heat treatment. Saving ofsilica sand using thermal reclamation process is possible. This paper gives theidea about reclamation of foundry sand is possible or not. (Joseph et al.

, 2017)2 identified that number of small foundry’s have not understand the qualityand reusability of foundry mould and core sand. It is important to study thequality of sand for reusability purpose and foundry economy purpose. Also whileusing the foundry sand, consideration of initial investment required forinstallation of small reclamation unit for small foundry are important. (Ramana, 2015) 3has given information about which one reclamationprocess is better from thermal reclamation process, dry reclamation process. dryreclamation process suitable one when the binder coat on sand grain is brittle. Also according to the reclamation process selection of binder is done. (Lucarz, 2013) 4has discussed different construction of thermalreclamation units like horizontal, vertical etc.

also the position of variousunits for best reclamation result in efficient way by considering method ofreclamation, temperature, path of fluidization.

(Lucarz, 2015) 5haspresented ecological reasons, according toreclamation temperature for binder, suitable air supply etc. reclamationchamber heating to low temperature for energy saving purpose As well asmaintain suitable volume of combustion chamber without affecting reclamationprocess result. (Andrade et al.

, 2005) 6 studied thermo mechanical regeneration and leaching processes andinfluence of additive on the improvement of the mechanical properties of thesands, also gives ideas about calcination of foundry sand at the range from 450to 5500 C either using coupling additives or inorganic. Thistemperature is sufficient to obtain the initial properties of foundry sand. (Lucarz, 2015) 8identified similar destruction for binder which haveurea formaldehyde resin, urea-furfuryl resin and alkyd resin during temperatureincrease, so that identification of temperature ranges for particular binderdestruction possible.(Berruti et al., 2009) 9 presented attrition nozzle of fluidized bed forgreen sand reclamation process.

Maintain nozzle pressure 350 or 550 kpa help toattrition process. It is possible to use nozzle pressure for sand bubblingprocess in silica sand reclamation system. 2. Study of foundry sand reclamation FoundrySand Reclamation: Thereare various types of foundry sand reclamation techniques such like a MechanicalAttrition Reclamation and Thermal Sand Reclamation from this two types ofreclamation processes widely used technique is thermal sand reclamation. Thermal sand reclamation technique actually uses mechanical attrition as wellas thermal reclamation in this process sand is heated at about 800 degree c. this process of reclamation is carried out in specially designed furnace where thesand is both fluidized as

well as heated. Thermally reclaimed sand is better than mechanicallyreclaimed sand as well as fresh sand because of follows reasons :(1) Thermally reclaimed sand is good than fresh sandbecause it is more rounded in shape causing lesser binder demand.

(2) Thermally reclaimed sand can be used with anychemical binder system in the subsequent manner. (3) As most of the sand is reused, almost no dumpingis necessary resulting in safer environment. (4) Conserves natural resources by eliminating needof new sand. (5) This is a highly energy efficient process. 2. 1Differentiation of Thermal Sand Reclamation: Differentiation of thermal sandreclamation depends on various factors like available space, quantity of usedfoundry sand, Economical, environmental, technical.

1. Availablespace According to the available space design of thermal sand reclamation takeplace general design of reclamation plant is horizontal, due to this type ofdesign, capacity of reclamation plant increases. In some cases space forreclamation are small that time compact structure reclamation plant is veryimportant.

2. Capacity of reclamationplant Reclamationplant capacity is totally depends on space available for reclamation but ifcapacity of plant are small compared to other reclamation plant then there isbig changes in structure of plant for small reclamation unit structure ofreclamation is vertical otherwise it is horizontal, Vertical structure savemore space also it is economical one.

4 3. Technical Technical point include above all point during design process, accordingto technical data design, structure, cost, available space

etc. take as aprimary input. During development process three trends can be found inliterature the first one is concerned with production plant which, driven byeconomical reasons for their own purpose.

The second trend concern with use ofparticular sources of energy in order to provide economical reclamation systemand the third trend of the development of thermal reclamation appliance onperformance base, in this technique use of newly modified techniques aredevelop. Comparative research on thermal reclamation carried out by the use ofalready existing unit of commonly known principle of operation and newly developedunit of reclamation Fig. 4. 1 Horizontalthermal sand reclamation unit Fig. 4. 2 Vertical thermal sand reclamation unit2.

2Fluidized Bed Type: Fluidized Bed types areclassified based on flow behavior is as follows; 1. Vibratory fluidized beds –Vibratory fluidised bed are similar to stationarybeds, but add a mechanical vibration to further movement of the particles forparticular work. 2. Circulating fluidized beds (CFB) – In CFB, developed gases are re-circulated via an external loop back into the reactorbed. 3. Annular fluidizedbed (AFB)– In annular fluidised bed a large nozzle at the centre of a bubble bedintroduces gas as high velocity achieving the rapid mixing zone then found inthe external loop of a CFB.

Due to high velocity its difficult task to maintainconstant temperature and reduce temperature drop problem. 4. Mechanically Fluidised Reactor (MFR) – Mechanicalstirrers is used for particle movement and achieve properties similar to that awell-mixed fluidised bed. It does not require fluidisation any

type of air orgas. 5. Bubbling fluidized bed – Bubbling fluidized bed is the techniquewhere the air or gas at low velocities is used and fluidization of the solidsfine particles take place. 11 because of bubbling fluidized bed problem oftemperature drop reduces. Pictorial representation of fluidized bed combustion is given in thefigure below: Fig.

4. 3 Fluidized bed combustion 2. 3Heating unit: Thermal sand reclamation process is totally depends on the heat treatmentgenerally there are three temperature ranges for removing binder from foundrysand. Temperature range are as follows first, 400 degree c. for low temperaturereclamation, 600 degree c. for medium temperature reclamation and the last oneis 850 degree c.

for high temperature reclamation. According to thistemperature various heating sources are used. However, the operation of most ofthem is based on the process of gas burning. In such condition used sand isreclaimed in the fluidized bed. A gas burner type technique basically suitablefor large capacity horizontal type of reclamation unit, control over the gasburner is quite difficult and skilled work. Another type of energy sources for reclamation process is found inmarket but electrical current as to initiate the process of burning. The advantageof this technique is the fact that there is no loss of energy because grainsare not overheated. Following are some advantages of electric heating techniques1.

With the help of electrical current heatingtechnique protection of grain from overheating as well as focusing on efficientenergy use. 2. For compact

size reclamation plant electric heatingtechnique is preferred. 3. No need of developing special arrangement for heatcontrol. 4.

Temperature range like low, medium, high creation isnot big task. Control of temperature is quite easy then gas heating technique. Required temperature creation with the help ofheating Coil is quite easy. This type of induction heating technique is widelyuse for melting metal. For example to melt aluminium with the help of inductioncoil, 4.

86 kw power heating coil required. (Literature) by using this techniqueheating coil design or selection is possible. Following are two types of heating unit exist in the market for variouspurposes.
Fig.

4. 4 Gas burner heating unit Fig. 4. 5 Inductionmelting furnace heating coil4. 5 Insulation: “ Insulation is a material or substance that is used to stop heat, electricity going into or out of something.” A thermalinsulator is a poor conductor of heat and has a low thermal conductivity. Insulation is used in manufacturing processes to prevent heat loss or heatgain. Although its primary purpose is an economic.

Some benefits of insulationare as follows. 1. It Provides fire or heat protection to equipment. 2. It Reduces over-all energy consumption. 3. No Heat absorption andsubsequent dissipation. 4.

It create Environmental friendly atmosphere, withthe right insulation, you can reduce the use of excessive energy, which in turnreduces CO2 emissions into the atmosphere. 4. 5. 1Classification of Insulation According

to thetemperature ranges and application insulations are classified are as follows: Low Temperature thermal Insulations (up to 90oC)This range of temperature covers insulating materials forrefrigerators, chilled and hot water storage unit, etc. The commonly usedmaterials are Cork, Wood, magnesia, Mineral Fibers, Polyurethane and expandedPolystyrene, etc. Medium Temperature thermal Insulations (90 – 325oC)Insulators in this range are usedin low temperature, heating and steam raising equipment, steam lines, flueducts etc.

The types of materials used in this temperatures range include 85%Magnesia, Asbestos, Calcium Silicate and Mineral Fibers etc. High Temperature thermal Insulations (325o C –above ) Typical uses of such materials are super heated steamsystem, oven dryer and furnaces etc. The most extensively used materials inthis range are Asbestos, Calcium Silicate, Mineral Fibre, Mica and Vermiculitebased insulation, Fireclay or Silica based insulation and Ceramic Fibre. Fluidized bed combustor use heating coil to achieve temperature at about800 degree c. because of that temperature large amount of heat is generated, due to this temperature possibility of human injury as well as systemperformance defect to avoid this injury and defect it is very important toprovide a insulation over a heating coil. High temperature insulation; ceramic wool are suitable over heating coilof fluidized bed combustor for foundry sand reclamation.

Nozzlesfor sand bubbling effect- “ Bubbling effect of the sand is the phenomena in which, minimum air or gas are supply to obtain bubbling of sand.” Design of nozzle forparticular work by using sand bubbling effect in such a way that sand does notgo inside the nozzle during working process.

Design of nozzle for particularair flow in such a way that nozzle air outlet size less then sand grain size. For example if gain size of sand are 0. 350 mm then size of nozzle hole shouldbe 0. 300 mm.

Conclusion Thereclamation processes used today have several limitations in the form ofrequired space, heating unit, suitable sand bubbling unit etc. this limitationneed to eliminate, but present thermal foundry sand reclamation unit designedfor particular work these are not capable to eliminate all problem. Due tothis, there is requirement of specially arranged and designed portablefluidized bed combustor for foundry sand reclamation. By using furnace designreference it is possible to design structure for FBC also design of heatingunit such as coil and insulation; for suitable sand bubbling effect design of nozzleby considering sand grain size is possible.

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