

Development of Mechanical Sand Reclamation System Using Roller Squeezing Mechanism

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Sand reclamation is currently one of the most important technologies for nobake sand plants from the perspective of waste minimization and reuse of mold sand. Conventional sand reclamation technologies are becoming increasingly obsolete due to the increasing popularity of high adhesion nobake binders such as Phenol Nobake (PNB) process and the growing need for reusing waste mold sand due to tighter environmental standards. Consequently, advanced sand reclamation technology suitable for PNB was desired.

To meet this foundrymen's desire, authors have developed advanced sand reclamation technology named *Roller Squeezing Type Reclaimer*. This system enables to reclaim used sand completely with lower LOI and higher mold strength. These results mean this technology contributes casting quality improvement since lower LOI eliminates gas defects caused by binder and higher mold strength eliminates sand inclusion and achieves superior dimensional accuracy.

Keywords: Sand Reclamation, Phenol Nobake, Squeeze, Ceramic Roller, Reuse

1. Introduction

Recently invented binders, such as PNB, adheres tightly onto sand grain surfaces. The adhered binder requires hard scrubbing to be removed. Conventional mechanical reclaimers, such as pneumatic type, attrition type or grinding type are insufficient to be applied for PNB. Consequently, kinds of mechanical reclamation mechanisms had been tried [1].

Finally, the advanced mechanical reclamation mechanism, named *Roller Squeezing Type* was developed [1-3].

2. Principle and Mechanism

Roller Squeezing Type Reclaimer consists of a pair of ceramic rollers and a rotating drum. Sand fed into the reclaimer makes a layer on the inner wall of the drum and scrubbed by the attrition among sand grains.

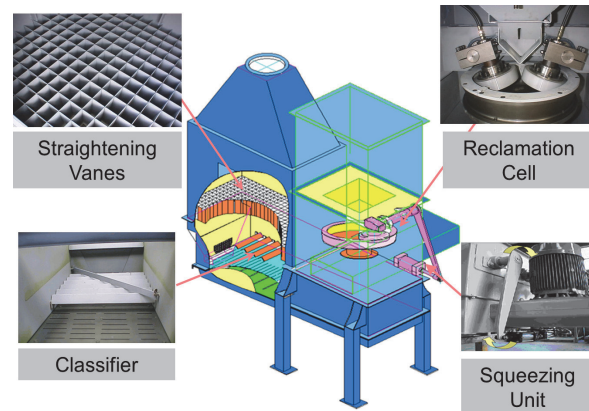


Fig. 1 Reclaimer Unit

Simultaneously, squeezing rollers press the sand layer. Combination of scrubbing and squeezing removes residual binder stronger than conventional methods.

Fig. 1 shows the whole unit of the reclaimer. The reclaimer consists of a reclamation cell, a fluidized bed type classifier, and a settling chamber. The settling chamber equips straightening vanes to separate sand grains and fines accurately.

3. Comparison Tests Against Conventional Reclaimer

A series of comparison test was conducted against rotary scrubbing type reclaimer, the most popular conventional reclaimer in Japan. Test conditions are given in Table 1.

Table 1 LOI Comparison Test Conditions

Binder	Ester-Cured Phenol Nobake (PNB)
Sand	Silica Sand (AFS GFN 39)
Motor Power	30kW/Pass
Throughput	5 MTPH

3.1 LOI Comparison

Fig. 2 gives the LOI comparison test result [2, 3]. As shown in Fig. 2, *Roller Squeezing Type* reaches the upper limit at second pass. However, conventional rotary scrubbing type requires four passes to reach the

upper limit. This result means *Roller Squeezing Type* requires only half energy compared to conventional method for achieving same LOI level.

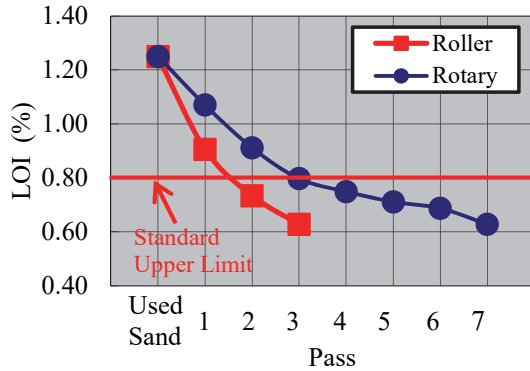


Fig. 2 LOI Comparison Result

3.2 Compression Strength Comparison

Using the same property sand, second pass for *Roller Squeezing Type* and fourth pass for rotary scrubbing type, compression strength of 50mm Dia. x 50mm Height test pieces was also compared. Table 2 gives the compression strength test conditions and Fig. 3 gives the test results [3].

Table 2 Compression Strength Comparison Test Conditions

Binder	Ester-Cured Phenol Nobake (PNB)
Sand	Silica Sand (AFS GFN 39)
Resin Content	1.4% Based On Sand (BOS)
Hardener Content	20% Based On Resin (BOR)

Fig. 3 shows that compression strength for reclaimed sand of *Roller Squeezing Type* is superior to that of rotary scrubbing type both after three hours and twenty four hours after molded. These results indicate that *Roller Squeezing Type* enables to remove firmly adhered binder without crushing sand grains. Besides, *Roller Squeezing Type* improves sand grain shape more rounded and compression strength is also increased by rounded sand grain shape.

4. Conclusions

Roller Squeezing Type Reclaimer achieves high efficiency and quality sand reclamation and reclaimed sand with this technology shows superior sand properties and mold strength against conventional one. These results mean this technology enables to improve reclaimed sand quality and then improved reclaimed

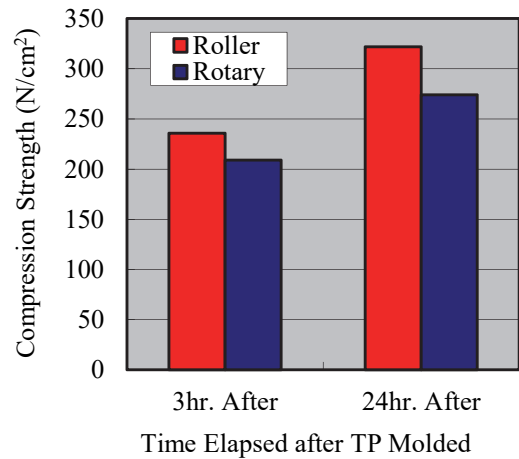


Fig. 3 Compression Strength Comparison Results

sand also improves casting quality. This technology was originally developed in Japan, however now spreads all over the world and contributes to sand quality improvement waste reduction. For example, it is reported that one Mexican steel foundry *Roller Squeezing Type Reclaimer* contributes to sand quality improvement [4]. In addition, *Roller Squeezing Type Reclaimer* and thermal reclamation system was compared in Europe and *Roller Squeezing Type Reclaimer* enables to replace thermal reclamation system [5].

Authors believe *Roller Squeezing Type Reclaimer* will change mind of foundrymen that mechanical reclamation is less powerful and reclaimed sand cannot be alternative of unused sand due to its low quality. And also, we expect this technology improves casting quality through high quality reclaimed sand.

References

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