



13-15 September / Eylül 2012, Tüyap, İstanbul

6th International Ankiros Foundry Congress
6. Uluslararası Ankiros Döküm Kongresi



Bu bildiri 6. Uluslararası Ankiros Döküm kongresinde sunulmuştur

This paper was presented on 6th Ankiros Foundry Congress

<http://kongre.tudoksad.org.tr/>

Eylül 2012
September 2012
Tüyap, İstanbul

Development of Aeration Molding Method and Practical use of Various-Type Green Sand Molding Machine

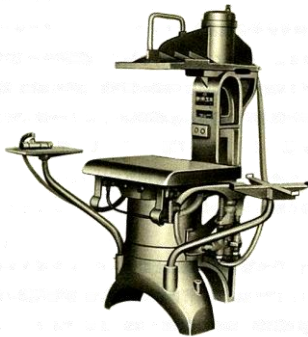
S. Tsuzuki , H. Makino , M. Hirata
SINTOKOGIO, LTD, Aichi, Japan

【Presentation Topics】

1. What' s SINTO?
2. Development of Aeration Molding Method
3. Various-Type Green Sand Molding Machines Using Aeration Filling Technology

What's SINTO?

- Trade Name : 新東工業株式会社 (English: SINTOKOGIO, LTD.)
- Head Office : Nagoya, Japan.
- Date of Establishment : Oct. 2, 1934.
- Paid Up Capital : ¥5,750,000,000. – (≒US\$72,000,000. –)
- Sales Volume : Consolidated A/c ¥105.0 billion (as of Mar. 31, '12)
- No. of Employee : Group 3,733 Sinto alone 1,653 (as of Mar. 31, '12)
- Group Companies : Consolidated subsidiaries – 41



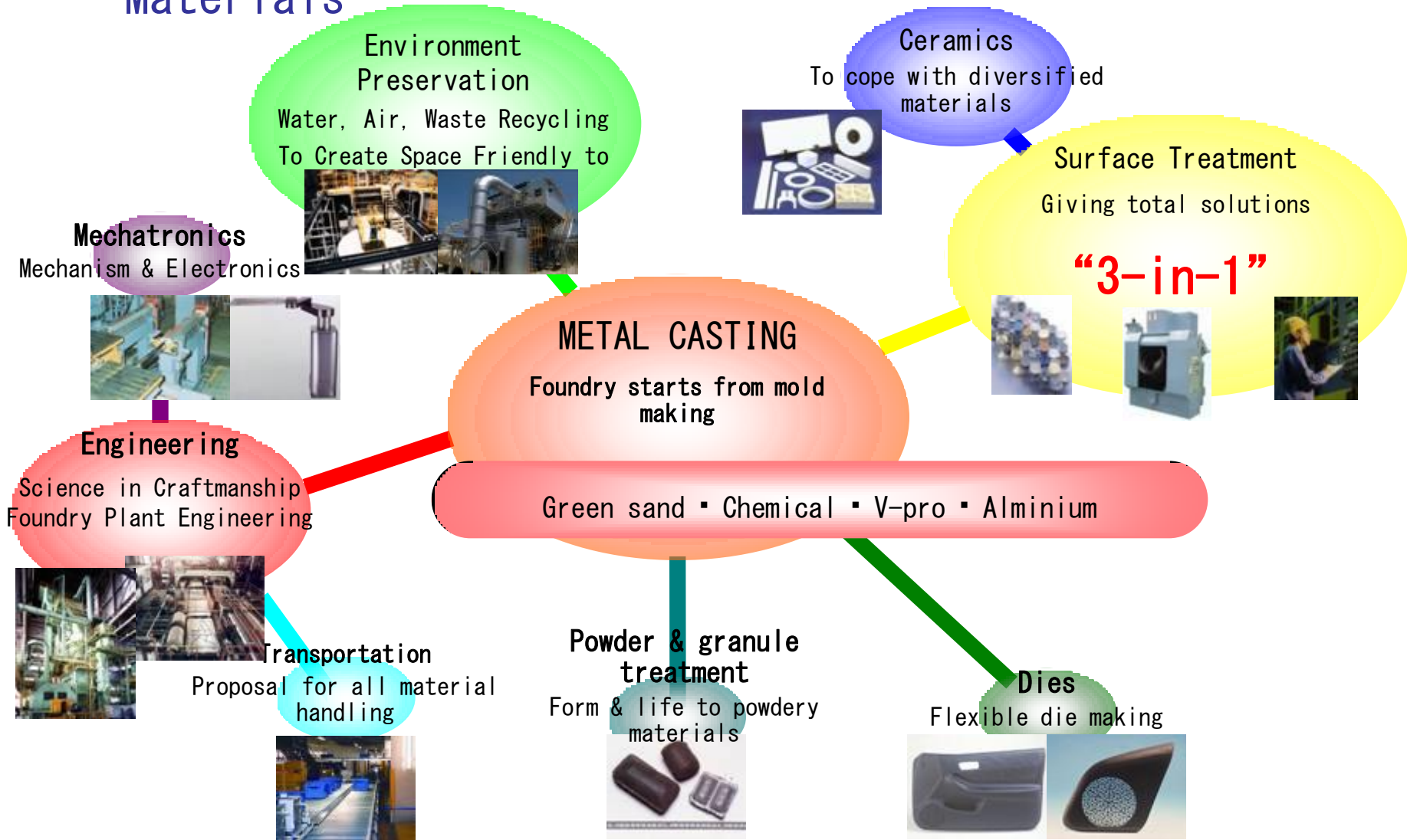
Model F-1 in 1943



Model ACE in 2000

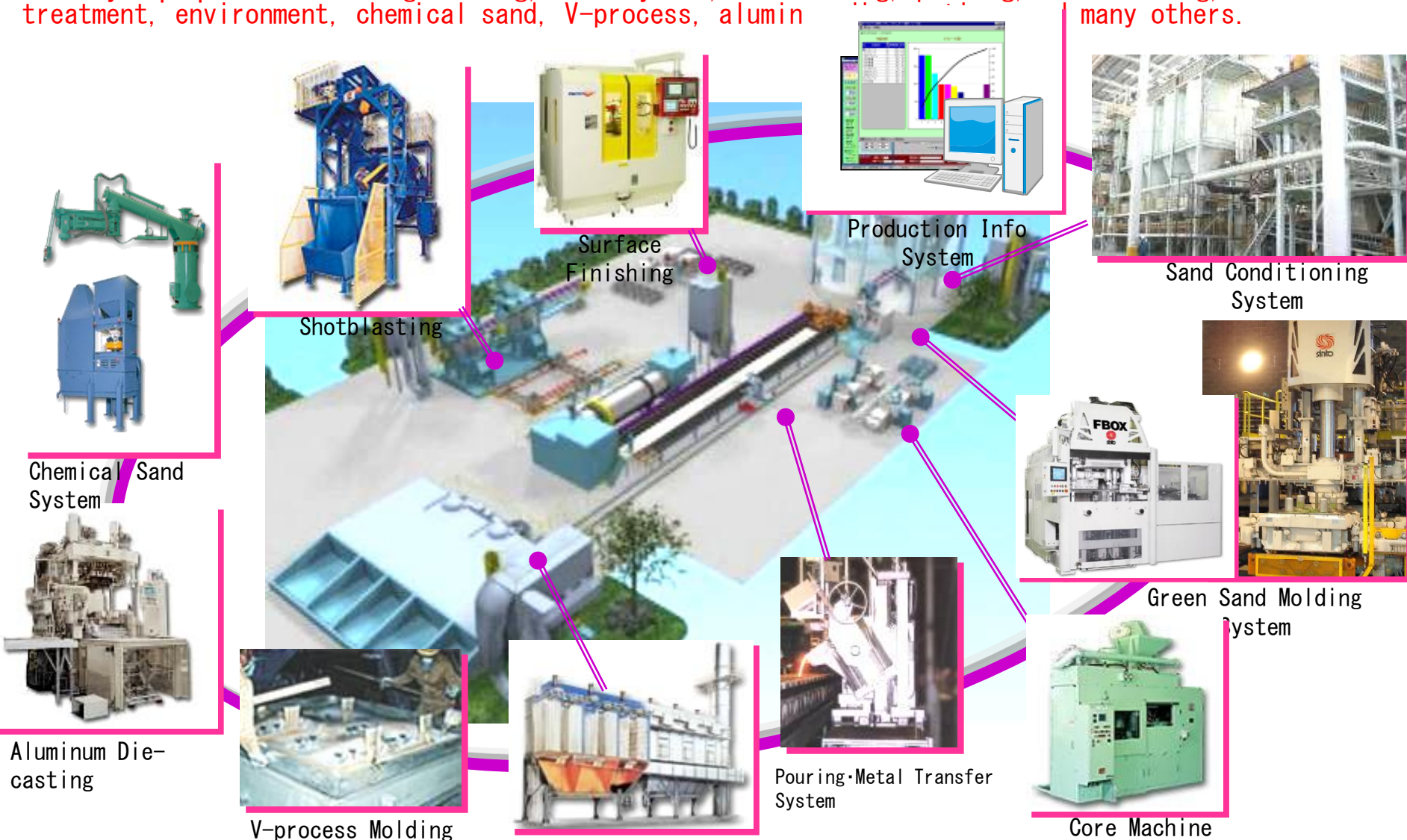
Our Corporate Philosophy

“Giving Form and Breathing Life to Process Materials”

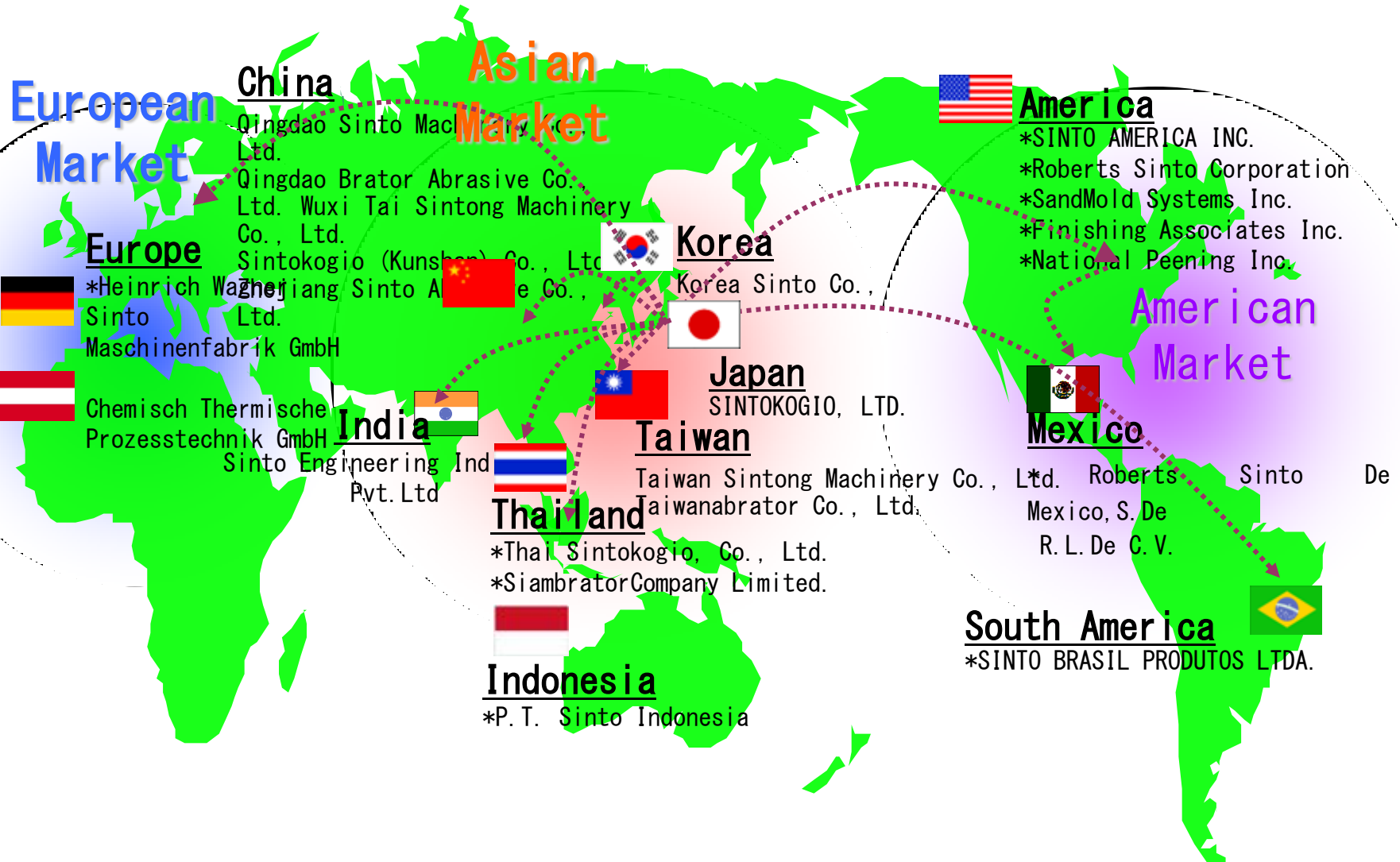


Foundry System Engineering of SINTO

Sinto is the only manufacturer in the world who can propose the total engineering of almost all foundry equipment including molding, sand system, core making, pouring, shotblasting, after-treatment, environment, chemical sand, V-process, alumin many others.



Global Network of SINTO



【Presentation Topics】

1. What's SINTO?
2. Development of Aeration Molding Method
3. Various-Type Green Sand Molding Machines Using Aeration Filling Technology

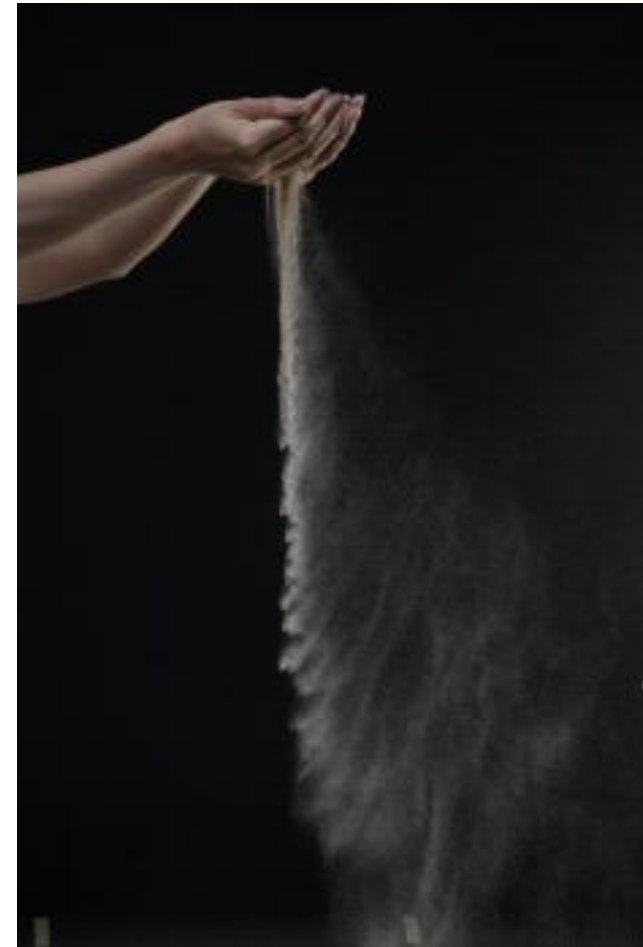
Aeration sand filling makes mold difference

Advantages of Aeration molding system

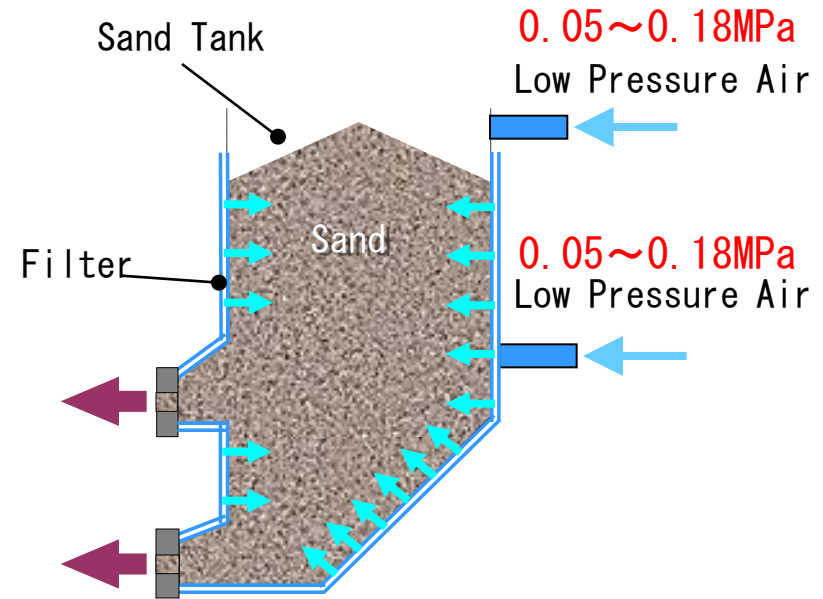
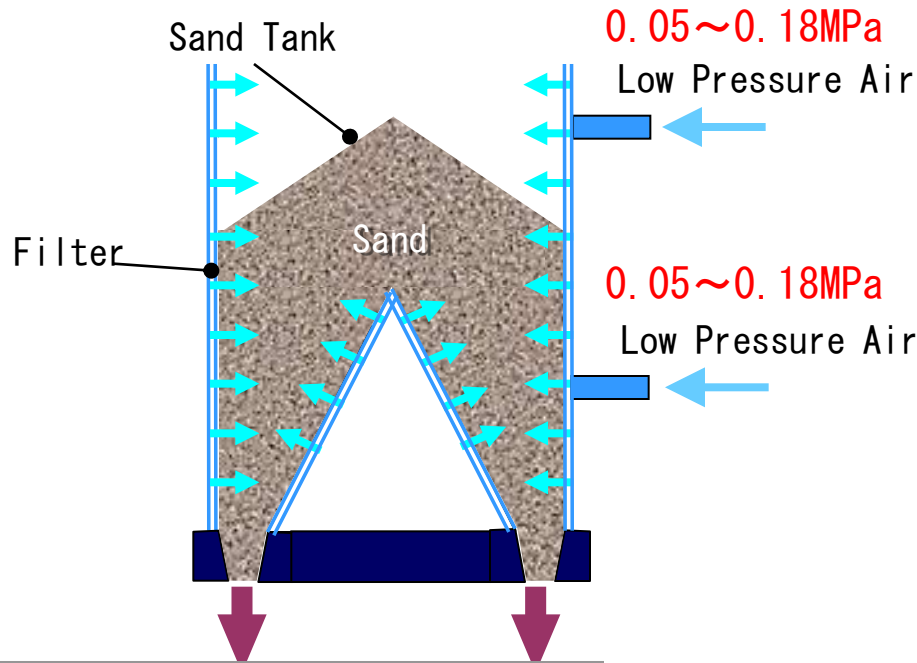
- Improvement of casting quality
- Low air consumption
- Saving energy
- Lower noise

Sinto's Molding Machine Line-up with Aeration Sand Filling system

- ACE : Tight flask
- FCMX : Flaskless (2 station type)
- FBOX : Flaskless (1 station type)
- FDNX : Flaskless (1 station type) **New**



What is Aeration Sand Filling...?



Advantages of

Aeration

■ Uniform mold filling density

■ Small bore pockets of complicated shape are filled uniformly without causing bridge at mouth

■ Air consumption reduced by 40% compared to Blow system. (Compared to our conventional type)

■ Noise level reduced to 72 dB (A)

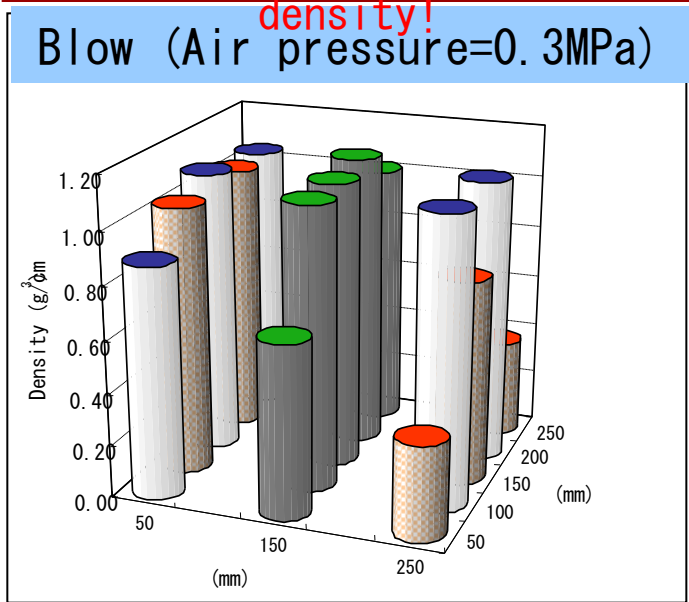
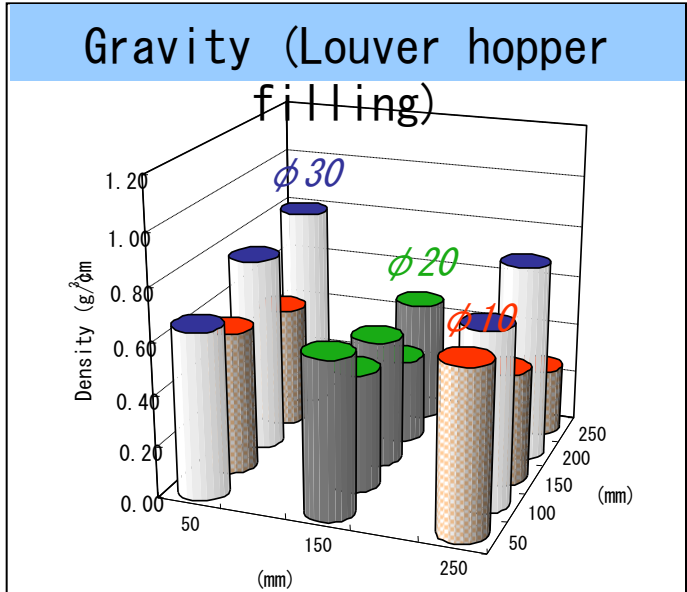
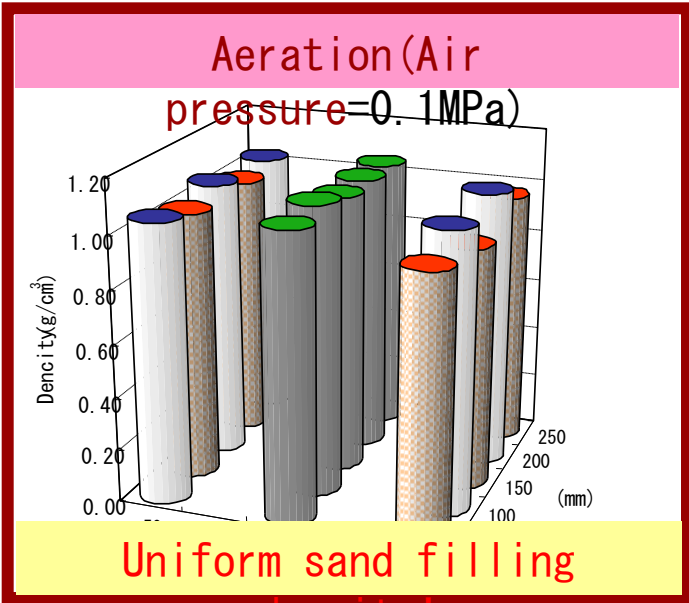
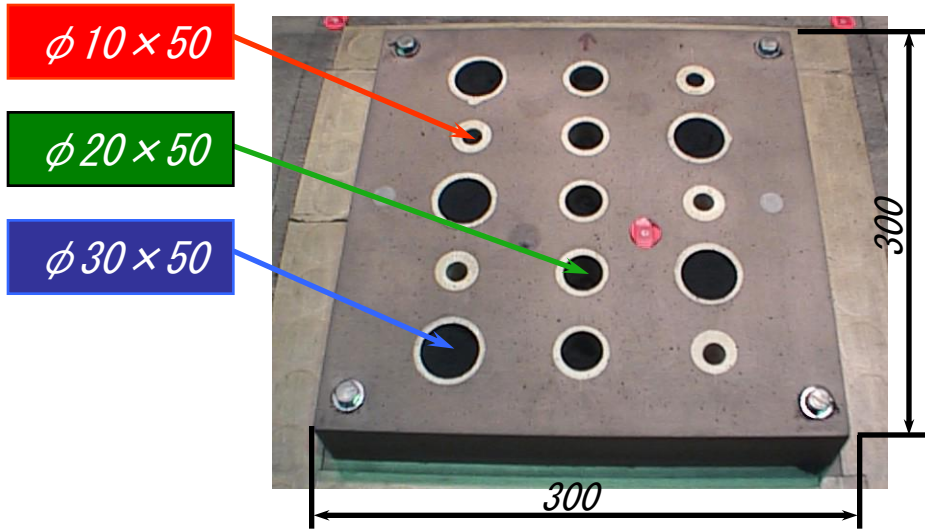
■ Wide range of applicable sand properties

SINTOKOGIO,LTD.

www.sinto.co.jp

6th International Ankiros Foundry Congress 2012 Istanbul, 13-15 September 2012

Experimental results of sand filling for small pocket.



Comparison Movie of Aeration, Blow and Gravity

Sand Filling Process



Aeration sand filling

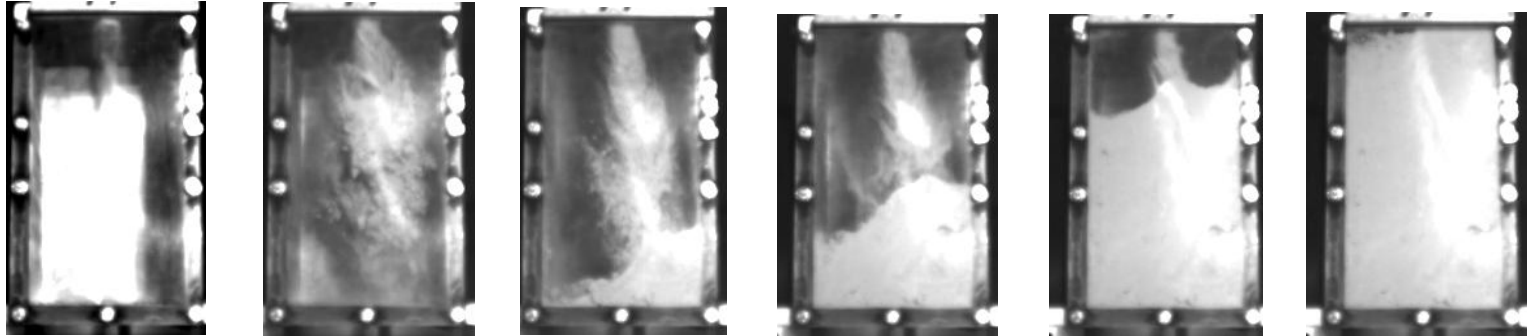
Collaborative Research with University

清華大學 (Tsinghua University)
Western Michigan University

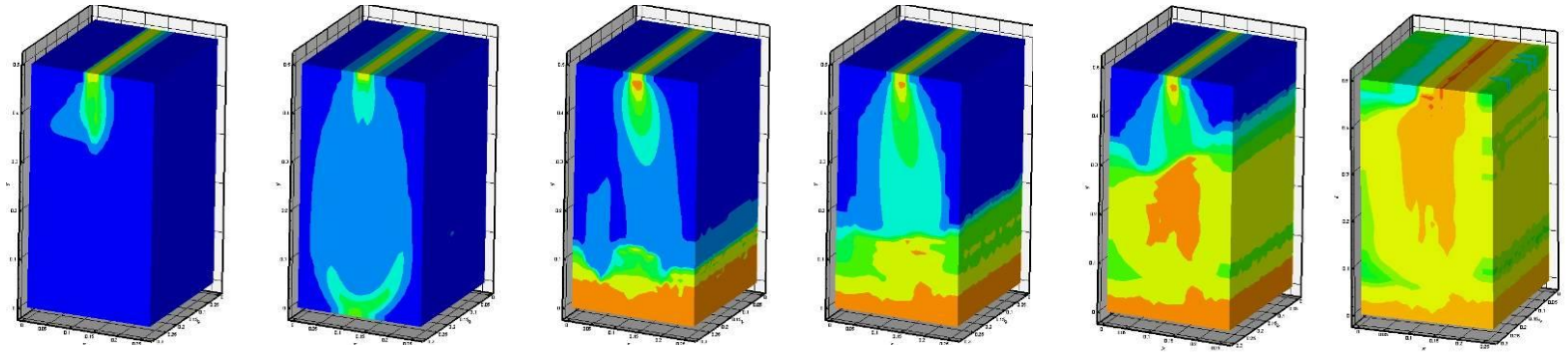
Simulation cases

1. The case without pattern

Experiment



Simulation



10ms
800ms

80ms

150ms

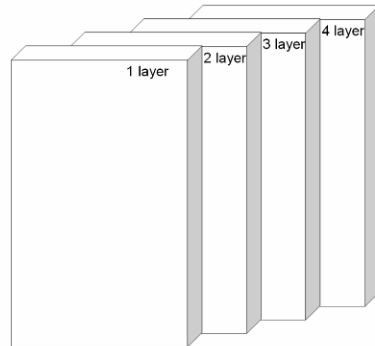
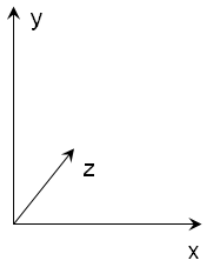
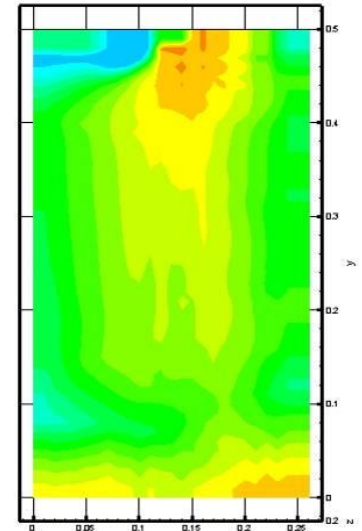
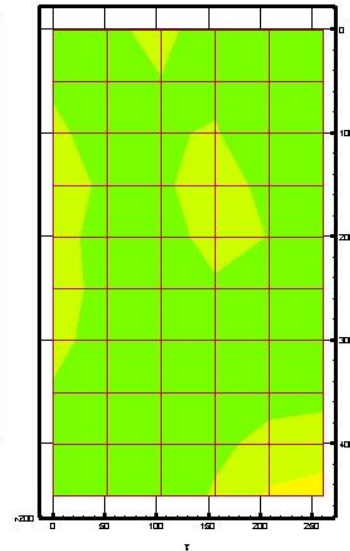
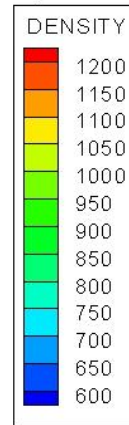
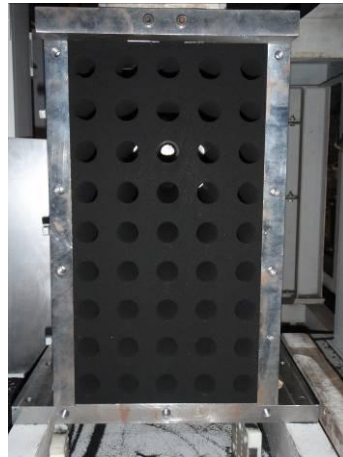
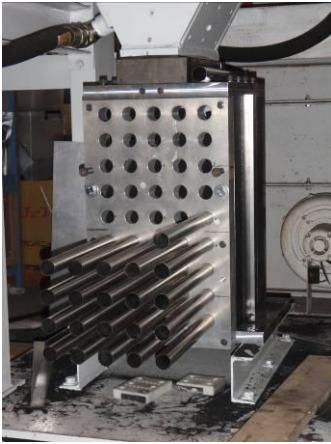
400ms

650ms

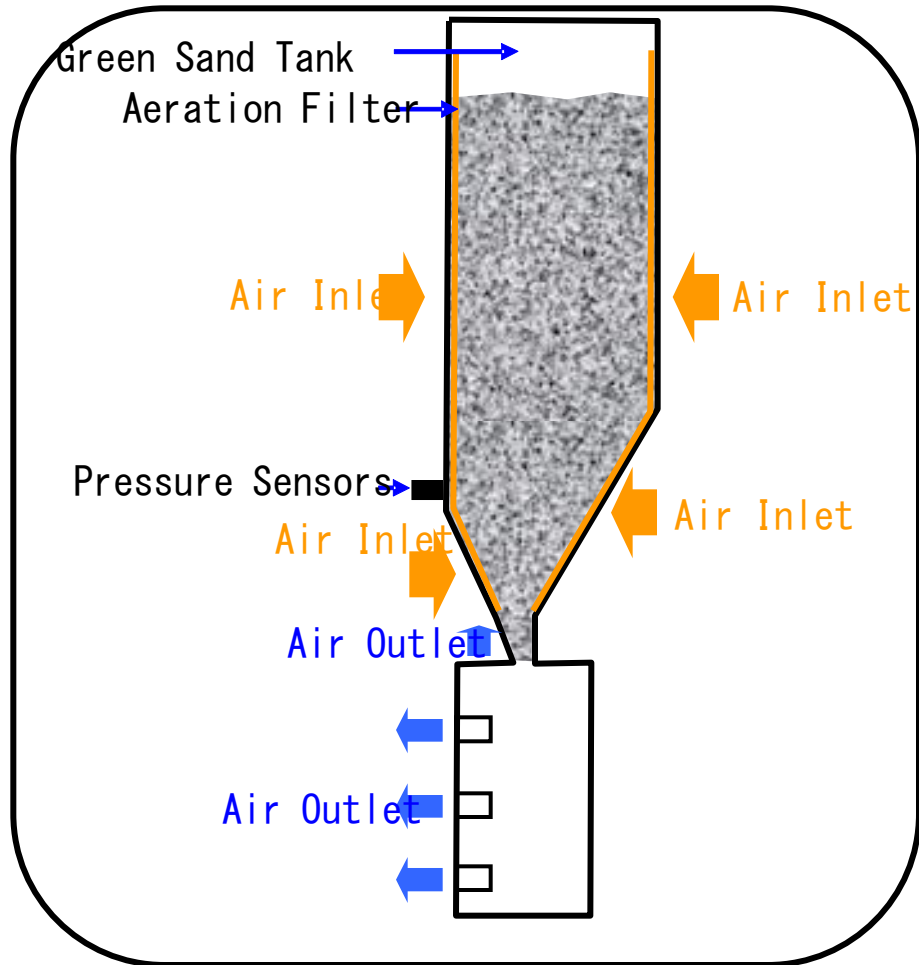
清华大学 (Tsinghua University)

Simulation cases

- The density distribution

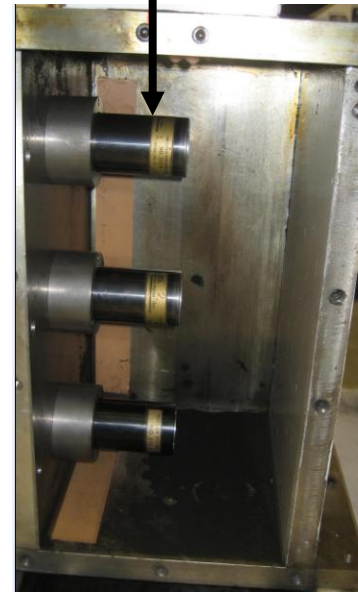


Schematic Illustration of Fundamental Aeration Sand Filling



AFS Specimen Tubes

Half-Section Sleeve
Ø60mm x H120mm



Western Michigan

Measured Properties of Green Sand

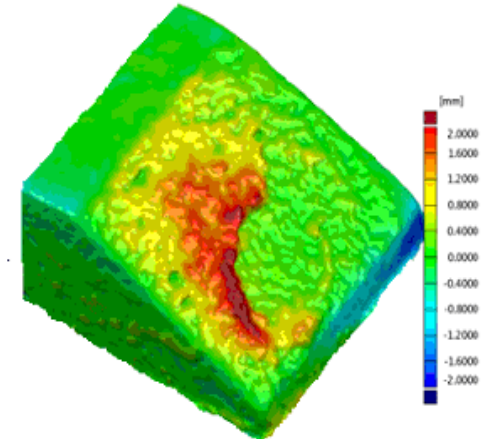
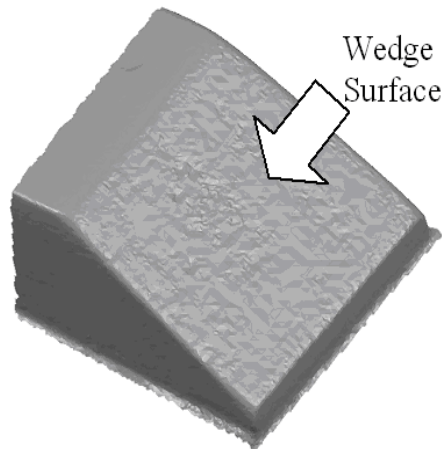
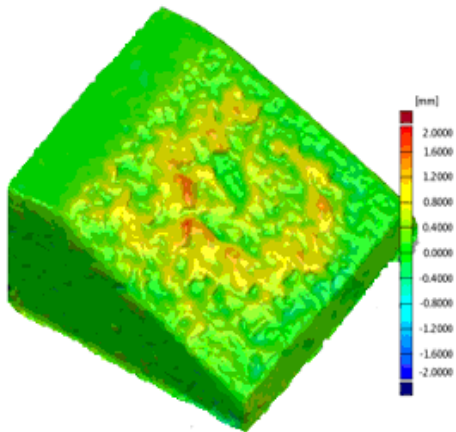
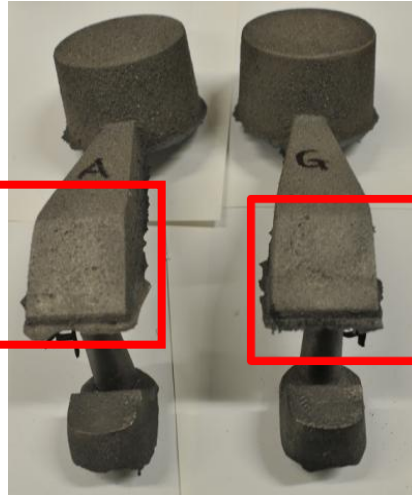
AFS Test	Aeration Filling			Gravity Filling		
Compactability (%)	30 <i>(0.2)</i>	35 <i>(0.2)</i>	40 <i>(1.0)</i>	30 <i>(1.0)</i>	35 <i>(1.5)</i>	40 <i>(1.0)</i>
Bulk Density (g/cc)	0.99 <i>(0.01)</i>	0.99 <i>(0.01)</i>	0.89 <i>(0.02)</i>	0.98 <i>(0.02)</i>	0.89 <i>(0.01)</i>	0.88 <i>(0.04)</i>
Moisture content (%)	2.5 <i>(0.02)</i>	2.5 <i>(0.01)</i>	2.5 <i>(0.01)</i>	1.9 <i>(0.14)</i>	2.5 <i>(0.05)</i>	2.7 <i>(0.10)</i>
Specimen weight (g)	160 <i>(1.0)</i>	158 <i>(1.0)</i>	158 <i>(0.5)</i>	158 <i>(1.0)</i>	158 <i>(1.5)</i>	152 <i>(0.5)</i>
Permeability (#)	220 <i>(1.0)</i>	223 <i>(1.5)</i>	228 <i>(1.2)</i>	228 <i>(2.0)</i>	233 <i>(1.0)</i>	261 <i>(1.0)</i>
Splitting Strength (psi)	3.4 <i>(0.12)</i>	5.4 <i>(0.20)</i>	5.1 <i>(0.10)</i>	3.9 <i>(0.05)</i>	5.4 <i>(0.10)</i>	5.0 <i>(0.09)</i>

Note: italicized number in parenthesis indicates standard deviation

Compression Strength (psi)	17 <i>(1.2)</i>	24 <i>(1.0)</i>	25 <i>(1.2)</i>	21 <i>(0.2)</i>	24 <i>(0.5)</i>	24 <i>(0.1)</i>
Mold Hardness (#)	93 <i>(1.5)</i>	94 <i>(1.0)</i>	97 <i>(0.5)</i>	92 <i>(1.0)</i>	94 <i>(1.2)</i>	96 <i>(1.1)</i>

SINTOKOGIO,LTD.

Erosion on Casting Surface



Western Michigan

【Presentation Topics】

1. What's SINTO?
2. Development of Aeration Molding Method
3. Various-Type Green Sand Molding Machines Using Aeration Filling Technology

SINTO's Molding Machine Line-up with Aeration Sand Filling system

Tight flask molding machine
ACE since 2000 109 units



Tight flask molding machine **ACE**

Flaskless molding machine 2 station
FCMX since 2004 85 units



Flaskless molding machine 1 station
FBOX since 2007 18 units



Award-winning record (7 winnings)

- 2002 : The Japan Machinery Foundation The 23rd Energy machine award "Minister of Economy, Trade and Industry Prize"
- 2002 : The 16th Chunichi Industrial Technology Award Chunichi Newspaper Prize
- 2002 : The Society of Plant Engineers Japan "Prize for Manufacturing"
- 2003 : The 19th SOKEIZAI Award "Minister of Economy, Trade and Industry Prize"
- 2004 : Japan Foundry Engineering Society Award for Technology
- 2005 : The 1st Japan Society of Mechanical Engineers Best Product Award
- 2007 : Japan Institute of Invention and Innovation Award

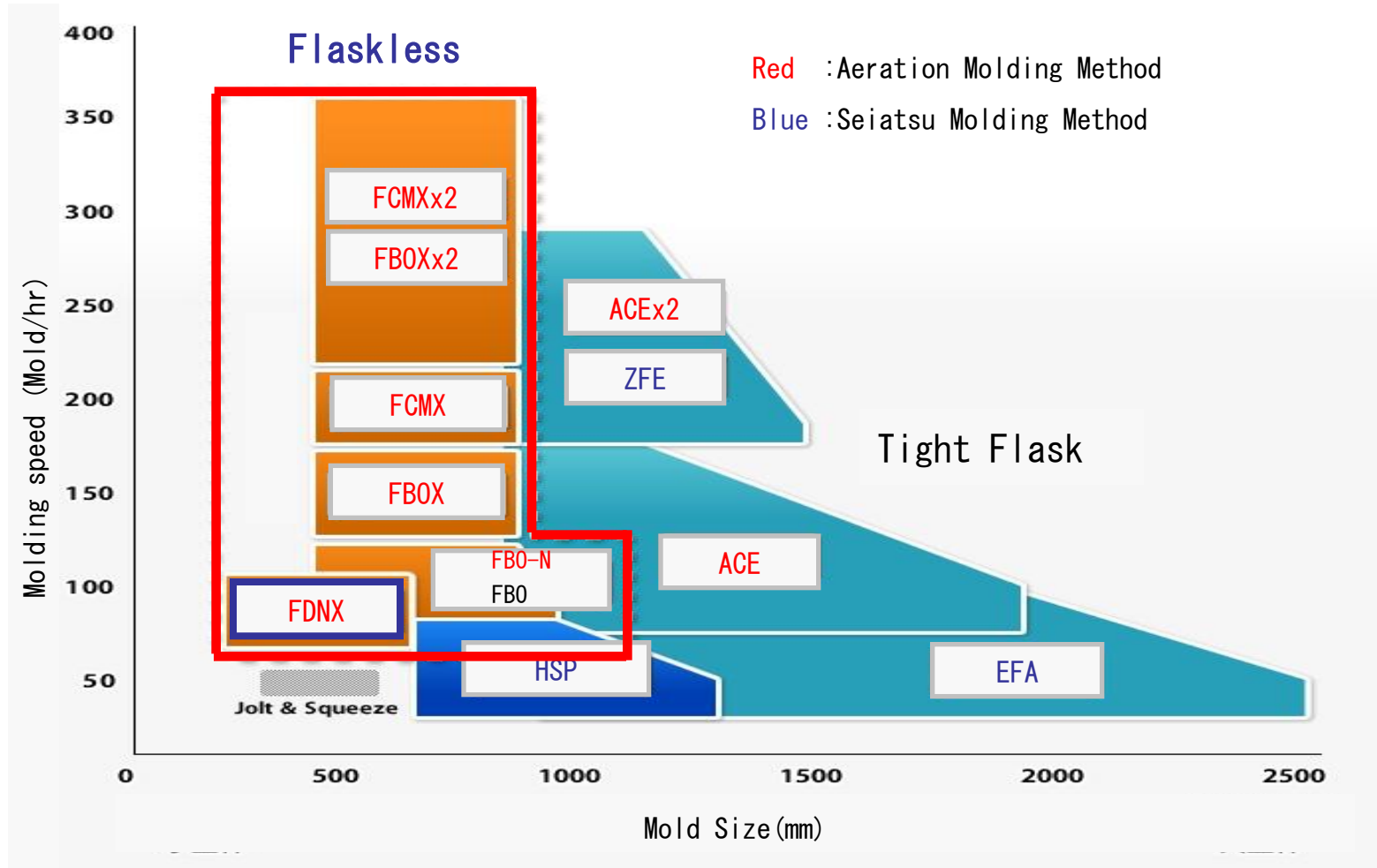
Horizontal parting flaskless molding machine **FCMX**

Award-winning record (2 winnings)

- 2006 : The Japan Machinery Federation The 27th Energy Machine Award "JMF President Prize"
- 2007 : Japan Foundry Engineering Society Award "Toyota Prize"

About **200 units** of Aeration sand filling molding machine has been sold.
This unique award-winning function is equipped in **ACE/FCMX/FBOX**.

SINTO's Molding Machine Series – Mold size & capacity



High-speed, high-performance full automatic molding machines have been developed by SINTO, however, automatic machine for small size casting and small/medium production volume has not been designed

SO FAR SINTOKOGIO,LTD.

www.sinto.co.jp

6th International Ankiros Foundry Congress 2012 Istanbul, 13-15 September 2012

Aeration Sand Filling Horizontal Parting Flaskless Molding Machine

FDNXseries



■ Features of FDNX

- By **automating molding of small casting**, productivity has been greatly improved from jolt-squeeze or hand molding.
- By adopting **aeration sand filling technology**, **energy saving and noise reduction** have been achieved, along with possible **high quality mold making**.
- Variation of mold quality generated by hand molding can be eliminated by automated molding. → **Stable and high quality mold making**
- Since sand is introduced into the sealed flasks (cope and drag), **waste sand and dust are greatly reduced**.
- **Working environment is far more superior** because of jolt-less molding.
- Machine can be **used immediately** after setting, piping and wiring.
- **Existing plates can be used**.

■ Specifications of FDNX

Mold size	Width x Length (mm)	450 x 350
	Height (mm)	Cope 150 / Drag150
Molding System		Cope and drag simultaneous side aeration + squeeze
Squeeze Surface Pressure (MAX)		0.7MPa (2 Stages selectable)
Aeration Pressure		0.05 ~ 0.18MPa
Power Source Rating		Power voltage: AC100~240V (Control Circuit: DC24V)
Weight of Mold (MIN~MAX)		71kg

“Aeration Sand Filling” Flaskless Molding Machine Model FDNX

Improved productivity and Labor saving



Molding Capacity at 100 mold/hr



Automation of labor
intensive molding work



Full automatic flaskless Molding Machine

5 Jolt-squeeze machines + 5 operators can be replaced with one new molding machine, FDNX plus one operator, increasing productivity and reducing labors.

“Aeration Sand Filling” Flaskless Molding Machine Model FDNX

Reduced running cost, energy saving and environment protection



Reduced sand consumption



Reduced splashed and spilt sand



Jolt-squeeze molding FDNX



New molding machine FDNX



Cope & drag simultaneous molding in confined space

Waste sand and dust generation are greatly reduced by changing molding method from gravity sand fill by conventional manual molding to sand fill into a confined space simultaneously to cope and drag

“Aeration Sand Filling” Flaskless Molding Machine Model FDNX

Improved environment



Reduced noise



Reduced vibration



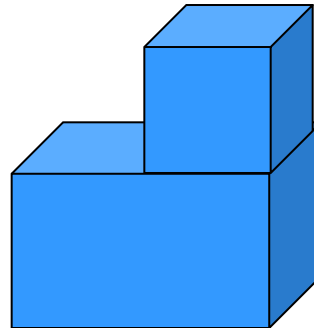
Aeration + Air-hydro
squeeze

Jolt-squeeze molding



90dB

Conventional automatic
flaskless molding



80dB



72dB

Aeration
molding



Equivalent noise level at 72dB(A)
Reduced vibration, better environment

Vibration and noise are greatly reduced by “aeration + air-hydro squeeze” molding system which does not use jolt, achieving better working environment.

Actual Installations



Thank You Very Much
For Your Attention!