POLISH ACADEMY OF SCIENCES - COMMITTEE OF MATERIALS SCIENCE
SILESIAN UNIVERSITY OF TECHNOLOGY OF GLIWICE
INSTITUTE OF ENGINEERING MATERIALS AND BIOMATERIALS
ASSOCIATION OF ALUMNI OF SILESIAN UNIVERSITY OF TECHNOLOGY

Conference Proceedings

12th INTERNATIONAL SCIENTIFIC CONFERENCE
ACHIEVEMENTS IN MECHANICAL & MATERIALS ENGINEERING

High Speed Roll Casting of Aluminum Alloy

T. Haga [a], M. Ikawa [b]

[a] Department of Mechanical Engineering, Osaka Institute of Technology
5-16-1, Omiya, Asahi-ku, Osaka, 535-8585, Japan

[b] Graduate School of Osaka Institute of Technology
5-16-1, Omiya, Asahi-ku, Osaka, 535-8585, Japan

We tried strip casting of aluminum alloys using a vertical type twin roll caster. Strips of A6063 alloy and A356 alloy could be cast at speeds higher than 60 m/min. The strips were thinner than 3mm. Moreover, we tried strip casting of A6063 alloy which increased Fe on the assumption that mixed impurities at the time of recycling.

1. INTRODUCTION

A twin roll caster has some advantages, for example they are energy saving, space saving, low running cost, and rapid solidification. However, the conventional roll caster has some disadvantages. They are low casting speed and poor mechanical properties. In recycling of aluminum, deterioration of the mechanical properties occurs by mixing of impurities. Therefore, the process which prevents deterioration of mechanical properties is needed. Then, in this research we tried strip casting of aluminum alloys at speeds higher than 60 m/min using a vertical type twin roll caster which heightened cooling capability. And, we tried making impurities detailed and harmless by rapid solidification.

2. EXPERIMENTAL APPARATUS AND CONDITION

Figure1 shows schematic illustration of the experimental apparatus. The twin roll caster had copper rolls for the improvement in cooling capability [1,2]. Copper rolls were arranged horizontally. Lubricant was not used on the roll surface. Molten metal was fed into the nozzle from a crucible through a cooling slope [1,2]. Side dam plates were used to prevent outflow of the melt to lateral direction. The main experiment conditions are shown in Table1. The materials for experiment were A6063 alloy, A356 alloy, and A6063 alloy which mixed impurities assumed recycling material. The content of Fe which mixed in A6063 alloy was 2 mass% (A6063+Fe2%).

3. RESULT AND DISCUTION

In A6063 alloy, A356 alloy, and A6063+Fe2% alloy, casting of continuous strip was possible at the roll speeds of 60m/min. Strip casting of A356 alloy was easier than A6063 alloy strip by the effect of adding of Si. The thickness of the strips were 2~3mm. The thickness of the strip is shown in Figure2. The thickness of A6063+Fe2% alloy strip was thinner than the thickness of A6063 alloy strip. Figure3 shows a photograph of the surface states of strips at as cast condition. There were no cracks in the surface of the strips. There was no influence by the difference of Fe content in surface of A6063+Fe2% alloy strip. Figure4 is shown microstructure of cross section of the strip at as cast condition. Microstructure near the center of the strip was not the same as microstructure near the surface of the strip. Cold rolling of the strip till t=0.5mm was possible. Figure5 shows thickness distribution of the as cast strip and as roll strip of A356 alloy. There were no cracks at cold rolling. And, Figure6 shows a photograph surface of A356 alloy at the condition of cold rolled at reduction of 80%. Figure7 shows cross section of the strips after homogenization, cold rolling, and T6 heat treatment.

Table1
Experimental Condition.

Roll	φ300mm×W100mm Copper, Water cooling, No lubricant
Material for experiments	A6063, A356 A6063+Fe2%
Roll Speed	60m/min (1m/sec)
Super Heat	15℃
Solidification Length	100mm
Molten Metal Head	100mm
Load (Spring)	14kN

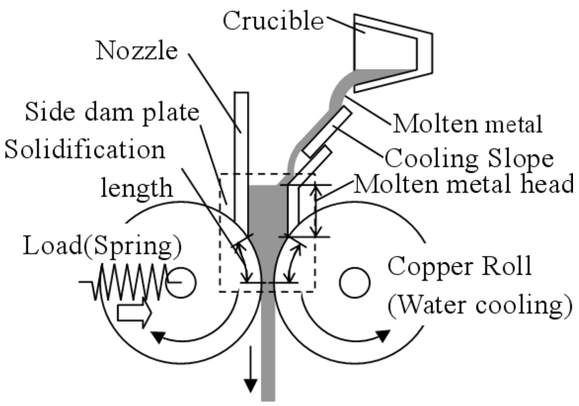


Fig.1 Experimental apparatus.

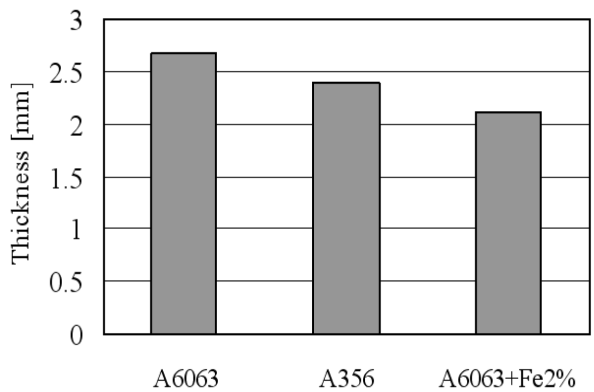
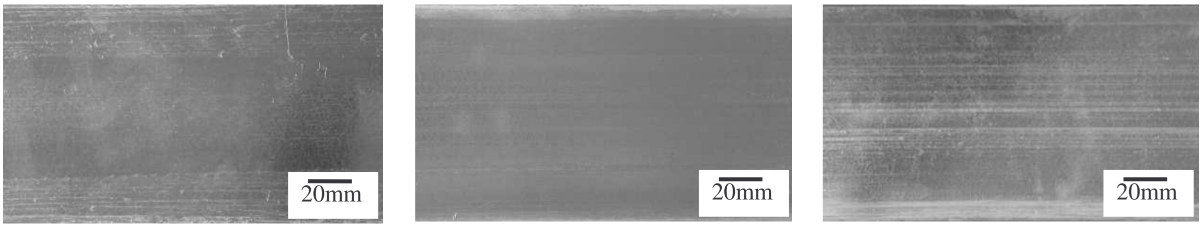


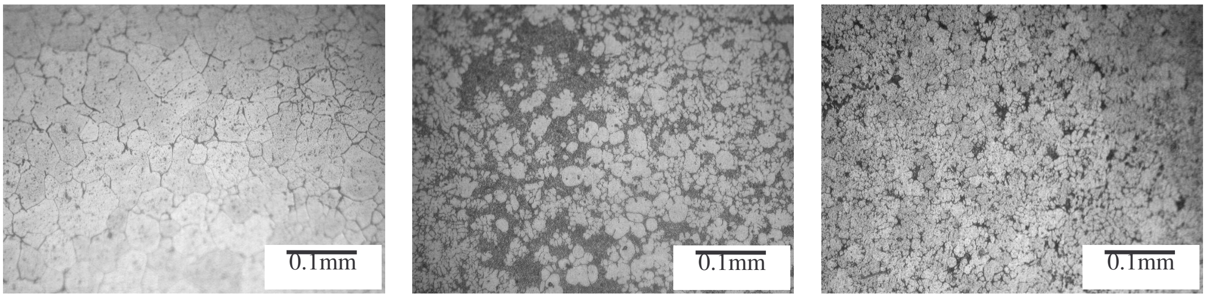
Fig.2 Thickness of the strip at as cast condition

In A356 alloy strip, size of eutectic Si was 5~6μm. Figure8 shows photograph of 0.5mm thick specimens subjected to the 180°bending test. The surface of A6063 alloy strip after T6 heat treatment shows no cracks. A6063+Fe2% alloy strip was bent without cracked too. However, the surface of A356 alloy strip after T6 treatment shows cracks. The surface of A356 alloy strip after solution heat treatment shows no cracks.



(a) A6063 (b) A356 (c) A6063+Fe2%

Fig.3 Surface states of the strips at as cast condition.



(a) A6063 (b) A356 (c) A6063+Fe2%

Fig.4 Microstructure of cross section of the strips at as cast condition.

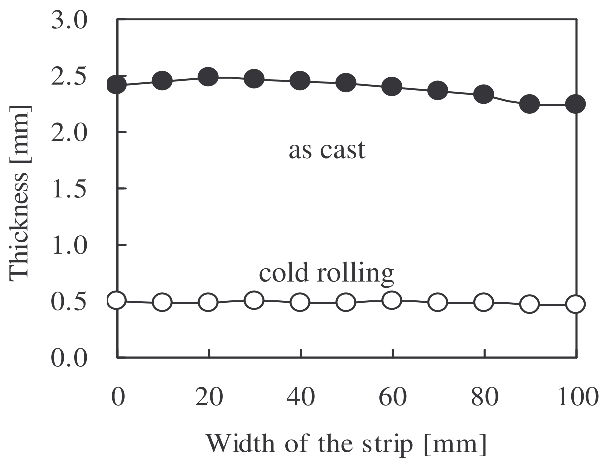


Fig.5 Thickness distribution of lateral direction of A356 alloy strip at the condition of as cast and cold rolled at reduction of 80%.

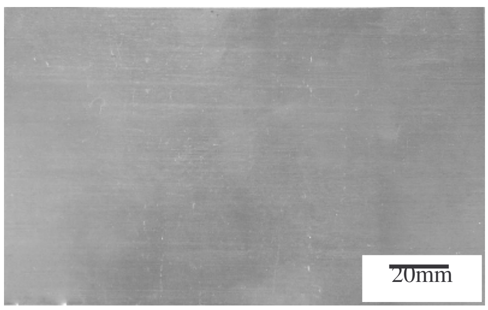
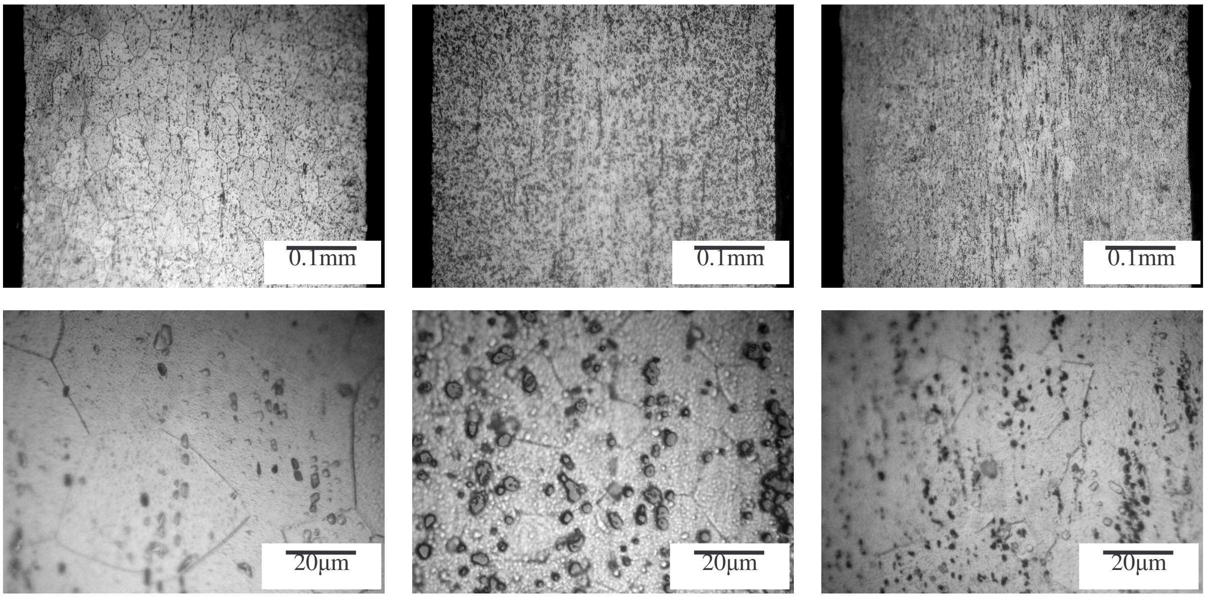


Fig.6 Surface states of A356 alloy strip at the condition of cold rolled at reduction of 80%.

4. CONCLUSION

High speed roll casting of A6063 alloy, A356 alloy was attained using a vertical type twin roll caster equipped with copper roll. And, roll casting of A6063 alloy which mixed Fe was possible at the roll speeds of 60m/min.



(a) A6063 (b) A356 (c) A6063+Fe2%

Fig.7 Microstructure of cross section of the strips (T6).

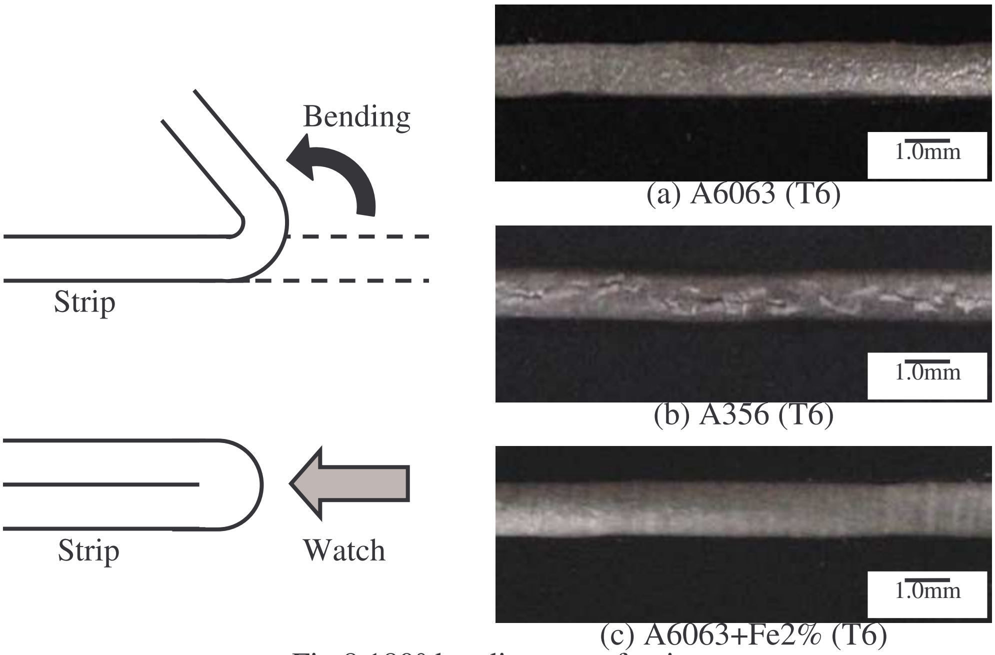


Fig.8 180° bending test of strip.

REFERENCES

1. T. Haga, J. Materials Processing Technology 130-131 (2002) 558-561.

2. T. Haga, S. Suzuki, Proceeding ICAA8, 2002, pp.83-88.