

Standard Aluminium Ingot Production From Aluminium Scraps

Somsak Prasertsook¹

¹Faculty of Industrial Engineering, Rajamangala University of Technology Suvarnabhumi Nonthaburi Center
7/1 Nonthaburi Rd. Tambol Suanyai Umpor Maung Nonthaburi Thailand 11000.
Sp_somsak@hotmail.com

The purpose of this research is to produce standard aluminium ingot from used aluminium scraps and chemical composition analysed by spectrometer to compare with Japanese standard specification. And the experiment results could summarize following. Aluminium car wheel scraps are suitable to produce aluminium ingot grade ADC 10 by adding Si, Cu, Zn, Grade ADC 12 by adding Si and Cu. Aluminium engine block scraps are suitable to produce ingot grade ADC 12 by adding Si. Aluminium pan scraps are suitable to produce ingot grade ADC 10 by adding Si and Cu. Aluminium thin sheet scraps are suitable to produce ingot grade AC 4 A by adding Si, Mg and reducing Mn. Aluminium electrical wire scraps are suitable to produce ingot grade ADC 1 by adding Si, grade ADC 3 by adding Si, Mg, grade ADC 6 by adding Mg grade ADC 10, ADC 12 by adding Si, Cu. Aluminium cans scraps are suitable to produce grade ADC 6 by adding Mg and reducing Cu, Mn. Aluminium foils scraps are suitable to produce ingot grade ADC 1 by adding Si, grade ADC 3 by adding Si, Mg, grade ADC 6 by adding Mg., grade ADC 10 by adding Si, Cu, Zn, grade ADC 12 by adding Si, Cu. However aluminium door alloy scraps are not suitable to produce aluminium ingot.

Keywords: *Aluminium ingot, Scraps, Spectrometer.*

1. Introduction

Normally aluminium foundries have been used specific aluminium ingots instead of aluminium scraps to produce the important parts of machines to meet the customer requirements because they considered about melting process which if they used aluminium scraps they often face with problems such as castings were not specific grade which ordered by customers. However specific aluminium ingots which imported from out sourced made production costs so high.

Therefore if they could produce standard aluminium ingot from used aluminium scraps it would be useful.



Figure 1 Aluminium engine blocks.



Figure 2 Aluminium pans.



Figure 3 Aluminium car wheels.



Figure 4 Aluminium Thin sheets.



Figure 5 Aluminium Foils.



Figure 6 Aluminium cans.



Figure 7 Aluminium electrical wires.



Figure 8 Aluminium doors.



Figure 9 Aluminum scraps melting.



Figure 10 Standard aluminium ingots.

2. Experiment Procedures

This paper is the experiment which collected aluminium scraps from used scraps and classification after that melted by 20 kilograms crucible furnace to get sample and checked the composition then melted to improve the composition again. The sample scraps were aluminium car wheels, aluminium engine blocks, aluminium pans, aluminium thin sheets, aluminium electrical wires, aluminium cans and aluminium foils.

3. Japanese Aluminium Ingot Specification

Table 1 Aluminium – Base Alloys Ingot for Casting

JIS	ALCOA	COMPOSITION IN PERCENT %									
		Si	Cu	Mg	Zn	Fe	Mn	Ni	Ti	Sn	Al
AC1A	195	1.2↓	4.0/5.0	0.3↓	0.3↓	0.5↓	0.3↓	-	0.25↓	-	Remainder
AC2A	108	4.0/6.0	3.5/4.5	0.2↓	0.5↓	0.8↓	0.5↓	-	0.2↓	-	Remainder
AC2B	319	5.0/7.0	2.0/4.0	0.5↓	1.0↓	1.0↓	0.5↓	0.3↓	0.2↓	-	Remainder
AC3A	13	10/13	0.2↓	0.1↓	0.3↓	0.8↓	0.3↓	-	-	-	Remainder
AC4A	-	8.0/10	0.2↓	0.4/0.8	0.2↓	0.5↓	0.3/0.8	-	0.2↓	-	Remainder
AC4B	380	7.0/10	2.0/4.0	0.5↓	1.0↓	1.0↓	0.5↓	0.3↓	0.2↓	-	Remainder
AC4C	356	6.5/7.5	0.2↓	0.2/0.4	0.3↓	0.5↓	0.3↓	-	0.2↓	-	Remainder
AC4D	355	4.5/5.5	1.0/1.5	0.4/0.6	0.3↓	0.6↓	0.5↓	-	0.2↓	-	Remainder
AC5A	142	0.6↓	3.4/4.5	1.2/1.8	0.1↓	0.8↓	0.3↓	1.7/2.3	0.2↓	-	Remainder
AC7A	214	0.3↓	0.1↓	3.5/5.5	0.1↓	0.4↓	0.6↓	-	0.2↓	-	Remainder
AC7B	220	0.3↓	0.1↓	9.5/11	0.1↓	0.4↓	0.1↓	-	0.2↓	-	Remainder
AC8A	A132	11/13	0.8/1.3	0.7/1.3	0.1↓	0.8↓	0.1↓	1.0/2.5	0.2↓	-	Remainder
AC8B	-	8.5/10.5	2.0/4.0	0.5/1.5	0.5↓	1.0↓	0.5↓	0.5/1.5	0.2↓	-	Remainder
AC8C	F 132	8.5/10.5	2.0/4.0	0.5/1.5	0.5↓	1.0↓	0.5↓	-	0.2↓	-	Remainder
AC9A	-	22/24	0.5/1.5	0.5/1.5	0.2↓	0.8↓	0.5↓	0.5/1.5	0.2↓	-	Remainder
AC9B	-	18/20	0.5/1.5	0.5/1.5	0.2↓	0.8↓	0.5↓	0.5/1.5	0.2↓	-	Remainder

Table 2 Aluminium – Base Alloys Ingot for Die Casting

JIS	ALCOA	COMPOSITION IN PERCENT %									
		Si	Cu	Mg	Zn	Fe	Mn	Ni	Ti	Sn	Al
ADC 1	A 13	11/13	0.6↓	0.3↓	0.5↓	1.3↓	0.3↓	0.5↓	-	0.1↓	Remainder
ADC 3	A 360	9/10	0.6↓	0.4/0.6	0.5↓	1.3↓	0.3↓	0.5↓	-	0.1↓	Remainder
ADC 5	218	0.3↓	0.2↓	4/11	0.1↓	1.8↓	0.3↓	0.5↓	-	0.1↓	Remainder
ADC 6	214	1.0↓	0.12↓	2.5/4.0	0.4↓	0.8↓	0.4/0.6	0.1↓	-	0.1↓	Remainder
ADC 10	A 380	7.5/9.5	2.0/4.0	0.3↓	1.0/3.0	1.3↓	0.5↓	0.5↓	-	0.3↓	Remainder

Table 2 Aluminium – Base Alloys Ingot for Die Casting

JIS	ALCOA	COMPOSITION IN PERCENT %									
		Si	Cu	Mg	Zn	Fe	Mn	Ni	Ti	Sn	Al
ADC 12	384	10/12	1.5/3.5	0.3↓	1.0↓	1.0↓	0.5↓	0.5↓	-	0.3↓	Remainder
		9.6-12	1.5-3.5	0.3↓	1.0↓	0.9↓	0.5↓	0.5↓	-	0.3↓	Remainder

4. Result and Discussion

Table 3 Aluminium Scraps composition From Tests.

JIS	COMPOSITION IN PERCENT %								
	Si	Cu	Mg	Zn	Fe	Mn	Ni	Ti	Al
Al. Car wheel	6.1	0.09	0.02	0.15	0.30	0.01	0.01	0.15	93.17
Al. Engine block	7.29	2.99	0.14	0.68	0.61	0.23	0.07	0.04	87.94
Al. Pan	5.36	2	0.08	1.34	1.28	0.20	0.13	0.04	89.57
Al. Thin sheet	0.92	0.15	0.04	0.06	0.51	1	0.01	0.02	97.29
Al. Electrical wire	0.14	0.05	0.06	0.07	0.3	0.01	0.01	-	99.36
Al. Can	0.44	0.18	2.20	0.09	0.58	0.73	0.01	0.03	95.74
Al. Foil	0.91	0.45	0.03	0.24	0.83	0.08	0.02	0.04	97.40
Al. Door	4.98	1.72	0.26	3.50	1.10	0.17	0.14	0.05	88.08

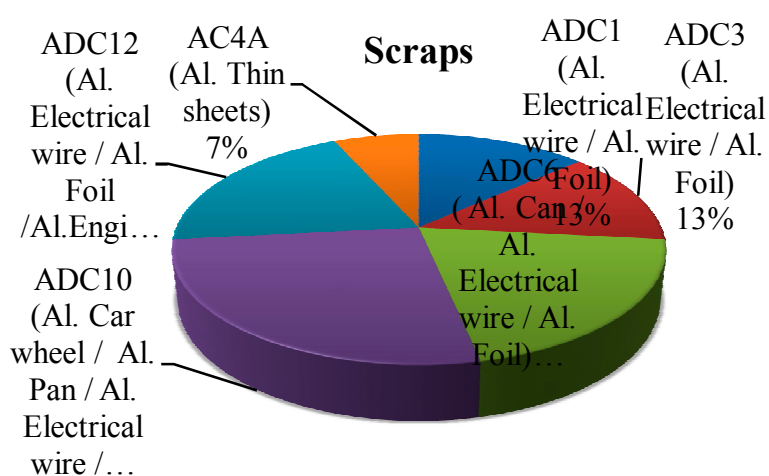


Figure 11 Standard aluminium ingot from 15 scraps type.

To produce standard aluminium ingot from used aluminium scraps and chemical composition analysed by spectrometer to compare with Japanese standard specification. And the experiment

results could summarize following. Aluminium car wheel scraps are suitable to produce aluminium ingot grade ADC 10 by adding Si 1.4%-2.9%, Cu 1.91%-3.91%, Zn 0.85%-2.85%, ADC12 by adding Si 3.5%-5.9% and Cu 1.41%-3.41%. Aluminium engine block scraps are suitable to produce ingot grade ADC 12 by adding Si 2.31%-4.71%. Aluminium pan scraps are suitable to produce ingot grade ADC 10 by adding Si 2.14%-4.14% and Cu 2%. Aluminium thin sheet scraps are suitable to produce ingot grade AC 4 A by adding Si 7.08%-9.08%, Mg 0.36%-0.76% and reducing Mn 0.20%-0.70%. Aluminium electrical wire scraps are suitable to produce ingot grade ADC 1 by adding Si 10.86%-12.86%, grade ADC 3 by adding Si 8.86%-9.86%, Mg 0.34%-0.54%, grade ADC 6 by adding Mg 2.44%-3.94%, grade ADC 10, ADC 12 by adding Si 7.36%-9.36%, Cu 1.95%-3.95%. Aluminium cans scraps are suitable to produce grade ADC 6 by adding Mg 0.30%-1.8% and reducing Cu 0.06%, Mn 0.13%-0.33%. Aluminium foils scraps are suitable to produce ingot grade ADC 1 by adding Si 10.1%-12.1%, grade ADC 3 by adding Si 6.6%-8.6%, Mg 0.37%-0.57%, grade ADC 6 by adding Mg 2.47%-3.97%, grade ADC 10 by adding Si 6.6%-8.6%, Cu 1.55%-3.55%, Zn 0.76%-2.76%, grade ADC 12 by adding Si 9.1%-11.10%, Cu 1.05%-3.05%. However aluminium door alloy scraps are not suitable to produce standard aluminium ingot by small crucible furnace because there are high Zn.

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