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양방향 TV 시대의 CRT S/M 기계적 특성 향상

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Ⅰ. Abstract

양방향 TV 시대에는 해상도 뿐만 아니라 사운드의 다양화 및 고음질화 되어 시각과 청각 특성 모두가 현장감, 박진감에 버금하는 시스템으로 변경되는 홈시어터 경향으로 더불어 오락 경기도 PC Game에서 Video Game의 위주로 전환 싯점에서는 사운드의 현장감은 더욱 더 절실히 요구되므로, 마이크폰닉에 대한 CRT의 특성 보완이 절실히 요구된다.

따라서, 본 보고서는 열적 변형과 좌굴에 의한 구조물의 안정성을 확보하기 위해서 Invar와 AK의 복합인 Claded Steel에 대한 좋은 특성을 소개하고자 한다.

Ⅱ. Introduction

Composite materials are new materials for the future. Studies and commercialization of composite materials for metal machine have been brisk since the 1960s. In particular, the aviation, space, and shipbuilding industries have developed composite materials of Ni alloy and other metals, thereby dramatically reducing shortcomings of the concerned combined metal. It has contributed to improving the quality and performance of the concerned products that use those metals. This report will be dedicated to explaining Invar-AK Claded, which combines Invar with less thermal discoloration and AK with strong tolerance to shock from use. It will complement weak points of he two metals, reduce production cost through the entire production process related to CRT and sheet steel production, and improves the quality of CRT. This composite materials of Invar and AK could be commercialized as a CRT material considering dynamic etching of S/M and existing S/M production environment. Furthermore, it is thought that it could help securing basic property for CRT shock and etc, considering mechanical characteristics.

Ⅲ. Experimental and Results

At present, when combining the two metals consecutively, current AK and Invar production has a difficulty in securing property of Claded products. Furthermore, in S/M and CRT manufacturing process, a gap between thermal discoloration and structures of the two metals brings about difficulties in securing the desired quality of CRT and S/M. Therefore, it is necessary to make a little bit of adjustment to chemical and mechanical properties of AK and Invar in order to augment advantages and minimize disadvantages of the two metals.

1. Chemical Property

A little adjustment was made to the formation ratio of C, Si and Ni considering changes in toughness and grain boundary in iron plate, S/M and CRT production process. Iron plate was the first target for this chemical property adjustment test.

2. Mechanical Property

The currently used AK has high thermal expansion coefficient, which leads to high Doming amount, a thermal discoloration property when it is applied for super size CRT and flat CRT. Therefore, it is difficult to secure Purity property even though S/M Ass'y is

Table 1 Comparison of Chemical Property

		C	Si	Mn	P	S	Cr	Cu	Al	Ni	Fe
Current Use	AK	0.004	0.04	0.2-0.4	0.018	0.015	0.05	0.08	0.02-0.08	Bal	
	Invar	0.04	0.25	0.25-0.4	0.012	0.012				35.5-36.5	Bal
Composite	AK	0.05	0.01	0.30	0.013	0.003	0.05	0.01	0.06	0.02	Bal
	Invar	0.005	0.06	0.22	0.003		0.03	0.03	0.005	35.5-36.5	Bal

Table 2 Comparison of Mechanical Properties

ITEM	Unit	Currently used AK		Currently used Invar		Composite Materials	
		Raw	After Heated	Raw	After Heated	Raw	After Heated
T.S	kgf/mm^2	66	20	60	35	45	27
Y.S	kgf/mm^2	60	12	60	21	43	9
Elongation	%	2	49	13	15	5.8	38.6
Hardness	Hv	191	57	190	110	130	78
Grain No.	ASTM	12	8	10	4	8	4-5
Young M	kgf/mm^2	21,300	20,000	14,300	11,000	17,000	15,000
Thermal Coef.	$10^{-6mm/°C}$	11	12	1	1.6	7	7.5
Spec. Heat	cal/g/℃		0.115		0.112		
N Value	ε5-10		0.31		0.2		0.28
Heat Conductivity	cal/cm/cm/s/℃		0.144		0.025		0.1

Table 3 Experiment Heat Treatment Conditions

	Rising Time	Keeping Time		Falling Time	D.P
Currently used AK	25℃/Min	750℃	15 Min	15℃/Min	−10℃
Currently used Invar	25℃/Min	850℃	20 Min	20℃/Min	5℃
Composite Materials	25℃/Min	750℃	10 Min	17℃/Min	0℃

* Heat Treatment Conditions for Each Metal

adjusted. As for Invar, Ni property of Invar produces a difficulty in creating tunic structure with Emissivity 0.7 on the surface of metal. To make matters worse, Invar's conductivity has bad property so that it contributes to 30% of thermal discoloration on CRT even though its thermal expansion

coefficient is 10% compared with that of AK. On the other hand, low young modules of Invar make Invar weak to external shock. Moreover, its low N value, Erison coefficient, in press forming and its high Spring Back due to young modules lead to low working hardening capacity, which then creates difficulties in producing working hardened curve. A single metal alone has a limitation in securing excellent CRT property by complementing the above mechanical properties. So, the following Table 2 shows that composite materials have mutually supplementary properties.

3. Iron plate Manufacturing Process

With the experiment setting that Invar is chosen as a Base Metal and AK as a Covered Metal, they go through consecutive heat treatment of 950 c/2.2 m/min and roll pressure ratio of 70%. This produces a thickness that was close to meet a desired one for the first

attempt. Then, they go through consecutive heat treatment of 950 c/9.0 m/min and roll pressure ratio of 20% Stretcher Leveling. This produces exactly the desired thickness.

4. Simulation of Purity Discoloration Property in CRT

With CRT in an active mode, internal S/M temperature changes to Max. 50c while AK and Invar with different thermal expansion coefficient create interactive force of expansion and compression. Ignorance of this interaction could bring about an asymmetrical discoloration that could take place on a screen in accordance with the distance of a screen like the simulation in Table 1. In general, total force created in the both ends of composite metals is less than that of each metal. Elongation of composite materials has different expansion and compression according to additional environmental changes including thermal expansion coefficient of the two metals. In principle, the following equation is used but not applicable considering S/M's heat flux that has Cone shape in Thick direction.

$$\sigma a^{*}Aa+\sigma i^{*}Ai=0,$$

$$Q=-K^{*}Grad^{*}T$$

$$\delta L=(Ea^{*}Aa^{*}\alpha\ a+Ei^{*}Ai^{*}\alpha\ i)^{*}t^{*}L/Ea^{*}Aa+Ei^{*}Ai$$

In composite materials of AK and Invar with different thermal expansion, getting Invar in the direction of Screen can make it easy to harmonize with the current entire structure of S/M Ass'y, complementing thermal expansion and structural stiffness, thereby improving quality of Purity property. This is because heat flux is good considering Emissivity and convective radiation

Ⅳ. Conclusion

As the above, characteristics of composite materials are explained. The result of simulation is an asymmetrical discoloration. However, it is necessary to make an adjustment to the data on actual values and input factors for simulation and concerned equation by applying the composite materials to CRT. Furthermore, it is thought that it is also necessary to make a technical, theoretical analysis of matching using material parts with Tension Type at the same time.