KAWASAKI STEEL TECHNICAL REPORT
No.12 (July 1985)
Special Issue on Hot-and Cold-rolled Steel Sheets

Spot-Weldable Vibration-Damping Composite Sheet Steel "NONVIBRA"

Masatoshi Shinozaki, Yoshihiro Matsumoto, Minoru Nishida, Toshio Irie, Yukio Furukawa, Junsuke Takasaki

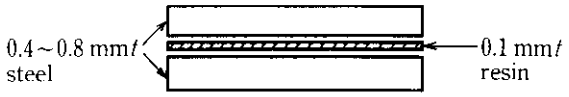
Synopsis :
Composite damping sheet steels which are composed of two steel-sheet skin layers and a centrally disposed viscoelastic resin layer have been attracting attention. The composite damping sheet steels have better damping ability than that of other types of damping sheets and similar formability to that of conventional sheet steels. Therefore, they are expected to be widely used for many machinery and equipment components. The composite damping sheet steels, however, have poor spot-weldability, because their core resins have no electric conductivity. A few methods of welding performance have been proposed to resolve such trouble. Kawasaki Steel has developed a spot-weldable composite damping sheet steel "NONVIBRA" by adding graphite particles to resin layers, and resolved this trouble basically. A role played by graphite is to provide a current path at the beginning of spot welding. A critical radius and critical amount of graphite particles for this purpose depend on the thickness of the resin layer. Graphite in the resin layer does not affect other characteristics such as the loss factor and adhesion.

The body can be viewed from the next page.

Sheet Steel "NONVIBRA"*1

Masatoshi SHINOZAKI*2
Toshio IRIE*5
Yoshihiro MATSUMOTO*3
Yukio FURUKAWA*6
Minoru NISHIDA*4
Junsuke TAKASAKI*7

Composite damping sheet steels which are composed of two steel-sheet skin layers and a centrally disposed viscoelastic resin layer have been attracting attention. The composite

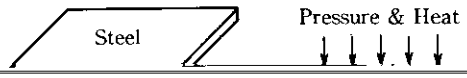


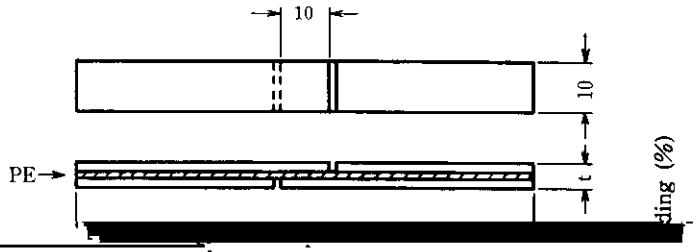
(a) Damping steel

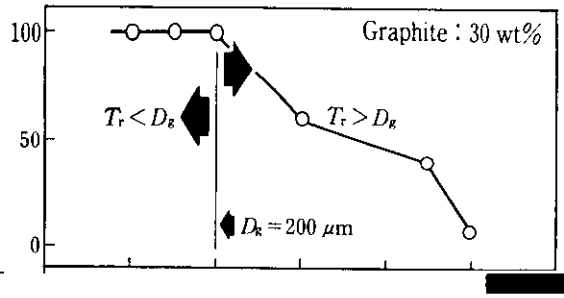
that of conventional sheet steel.

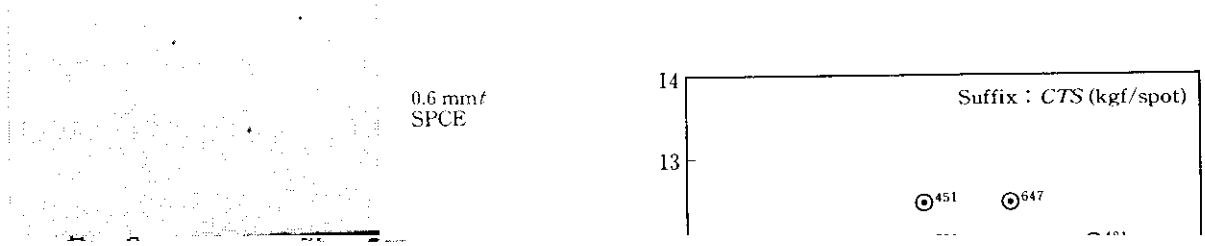
The authors have been making research on developing vibration-damping composite sheet steel suited to direct spot-welding by the same method as the conventional one, and achieved the objective by blending the viscoelastic resin, which causes vibration-damping

(a) Blend (b) Hot press (c) PE film



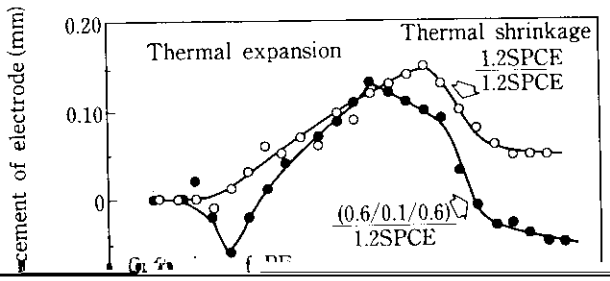

10
10
t
PE


100
50
0
Graphite : 30 wt%
$T_r < D_g$
$T_r > D_g$
$D_k = 200\ \mu m$


0.6 mm*t*
SPCE
14
13
Suffix : *CTS* (kgf/spot)
451
647

obtained. The fracture mode of the weld becomes a shear mode when the welding current is lower, and becomes base metal fracture when the welding current

shows wide dispersion. The reason for this is that it is difficult for uniform force to be applied to two skin steel



descends at three cycles in the initial stage of current conduction (indicating that the film has become thinner by 0.06 mm), and softening of the resin is clearly observed.

From the above test results, current conduction circuit formation by graphite is schematically expressed in **Table 5**. Assuming that film thickness and graphite content remain constant, the distribution of graphite in the film will be divided into three kinds, i.e. "fine grain and

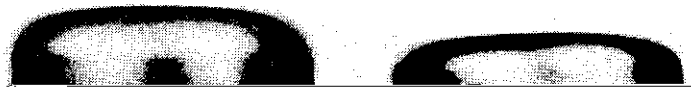
Table 6 Mechanical properties of composite damping steels

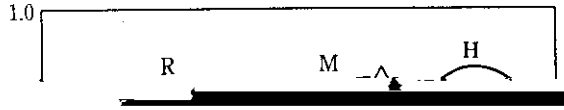
	Steel	Direction	*YS* (kgf/mm²)	*ST* (kgf/mm²)	*El* (%)	*Y.El* (%)	$\bar{r}$	*LDR*
Deep drawing steel	KTU-X (0.8 mm *t*)	L	14	30	51	0	2.06	2.21
		T	15	30	53	0		
		D	15	31	49	0		
Damping steel for use at room temperature	KTD-C(R) (0.8/0.1/0.8 mm *t*)	L	14	29	51	0	2.02	2.21
		T	14	29	53	0		
		D	15	31	49	0		
Damping steel for use at middle temperature	KTD-C(M) (0.8/0.1/0.8 mm *t*)	L	14	30	51	0	2.02	2.21
		T	14	30	51	0		
		D	15	30	48	0		

Tensile test: JIS No.5, G.L.=50 mm
LDR test : Punch dia. 33 mm, BHF 500 kgf, Lubricant G 790

thickness of *t*) having a side *l*. When the density values of the resin and graphite are denoted by [redacted]

damping composite sheet steel "NONVIBRA" having a [redacted]





electrode.

(2) The amount of graphite addition can sufficiently be