New Products & Technologies

Resin Composite Type Vibration Damping Steel Sheet, "NONVIBRA®"*

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1 Introduction

Quietness is being given greater importance for achieving a comfortable living environment, and attention is now focused on vibration damping steel sheet as a new raw material for this. Aiming at applications in automobiles, electrical appliances, construction materials, etc., Kawasaki Steel started the commercial production of vibration damping steel sheet (**Photo 1**) in December 1989. Various types of vibration damping steel sheets have been produced according to specific purposes, and an outline of these materials are reported here.

Photo 1 The view of steel and plastic laminating line (SPL)

Fig. 1 The schematic profiles of 2 types of NONVIBRA

2 Structure and Manufacturing Process

Welded-type **NONVIBRA®** vibration damping steel sheet has, as shown in **Fig. 1**, a structure of two steel sheet skins (general-purpose cold rolled steel sheets, precoated steel sheets, stainless steel sheets, etc. can each be used) sandwiching a resin layer (tens of micromillimeters thick) with vibration damping ability that incorporates a metallic filler to provide electrical conductivity. Both the boundary surfaces between the skin and resin are chromate coated to provide high corrosion resistance and adhesion.

The manufacturing process for NONVIBRA is shown in **Fig. 2**. Two degreased steel sheets, after being chromate coated, are coated with a resin having good vibration damping ability, dried and laminated by passing through heated rolls.[1]

3 Quality and Performance

The mechanism for the vibration damping ability of NONVIBRA involves the resin generating shearing deformation, so that vibration energy is absorbed by the visco-elastic resin and converted into thermal energy. **Figure 3** shows comparative vibration damping characteristics for NONVIBRA and an ordinary steel sheet. Compared with the ordinary steel sheet, NONVIBRA

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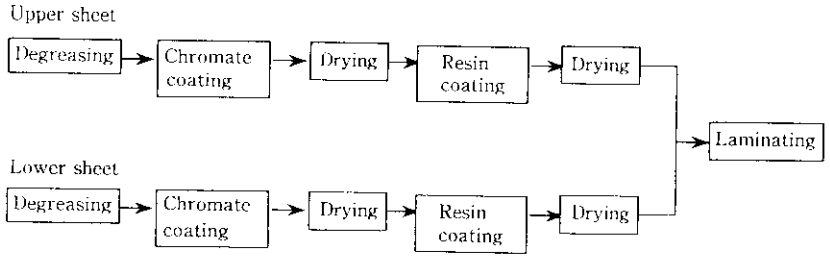

Fig. 2 Process of manufacturing NONVIBRA

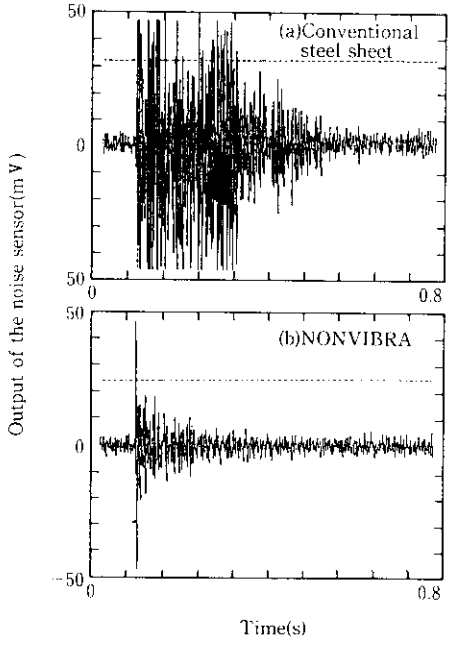

Fig. 3 Comparison of the vibration damping behavior between the conventional steel sheet and NONVIBRA (at 25°C)

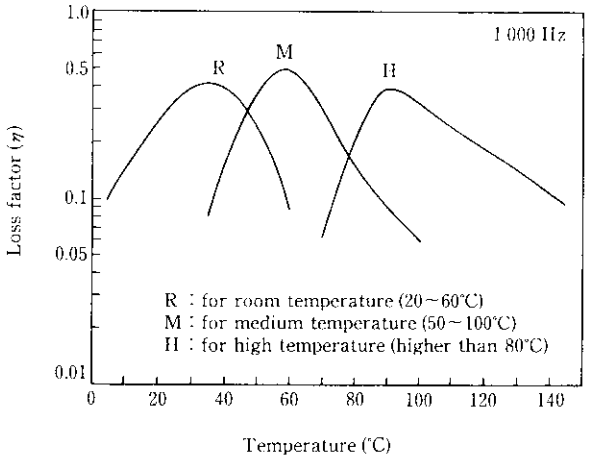

Fig. 4 Three types of the vibration damping resins for various temperatures

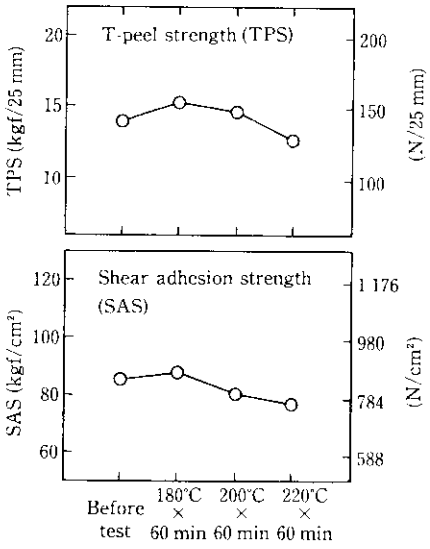

Fig. 5 Stability on the baking test

has very significant vibration damping ability. This vibration damping phenomenon occurs when a viscoelastic synthetic resin is in the glass transition region, and has temperature dependence. **Figure 4** shows the relationship between the temperature and loss factor for vibration damping steel sheets incorporating three kinds of resins manufactured by the company.[2] Each of the three resins has a particular temperature for the peak loss factor, so that the resin having the greatest vibration damping ability can be selected depending upon the temperature for use. A thermoplastic resin is normally used in vibration damping steel sheets, but the resin for NONVIBRA is of the thermosetting type. Its loss of adhesion strength at high temperatures is low, and it has sufficient heat resistance to the coating and baking processes used for manufacturing automobiles, electrical appliance parts and construction materials[3] (**Fig. 5**).

Since the vibration damping steel sheet has an intermediate layer that is an electrical insulator, resistance welding cannot be applied unless a conductive filler is added the resin layer to give sufficient electrical conductivity. As shown in **Fig. 6**, NONVIBRA vibration damping steel sheet provides nearly the same available welding current range as an ordinary cold rolled steel sheet. The steel sheet skin used for NONVIBRA material can be a cold rolled, hot-dip zinc-plated, electrogalvanized, stainless steel, etc., and the weldability of each depends upon the characteristics of the respective steel sheet skin.

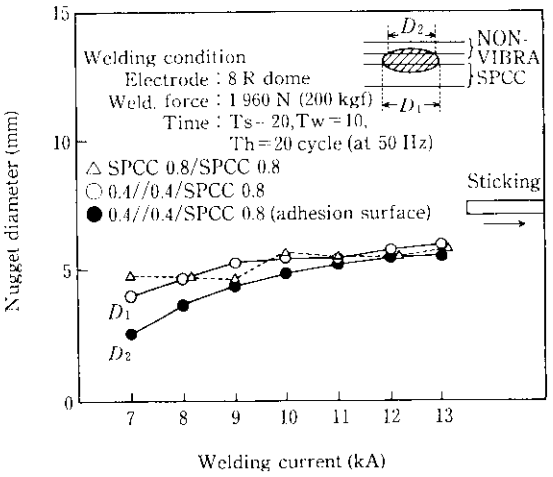

Fig. 6 The effect of welding current on nugget diameter

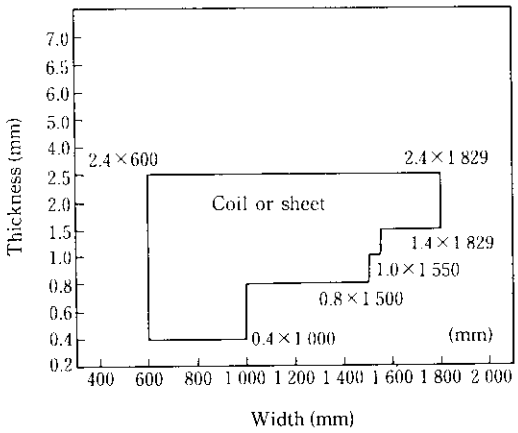

Fig. 7 The available size of NONVIBRA

4 Available Sizes and Application Example

The available size range for NONVIBRA vibration damping steel sheet is shown in **Fig. 7**. Products having a thickness of 0.5 to 2.4 mm and a sheet width of 600 to 1 829 mm are available.

As an application example of this vibration damping material, a petroleum-gas-burning fan heater (KD-325D model manufactured by Mitsubishi Electric Corporation) is shown in **Photo 2**. NONVIBRA is used for the casing of the turbo-fan, and has contributed to a decrease in noise during operation of about 5 dB (A), as well as impoving the sound quality.[4]

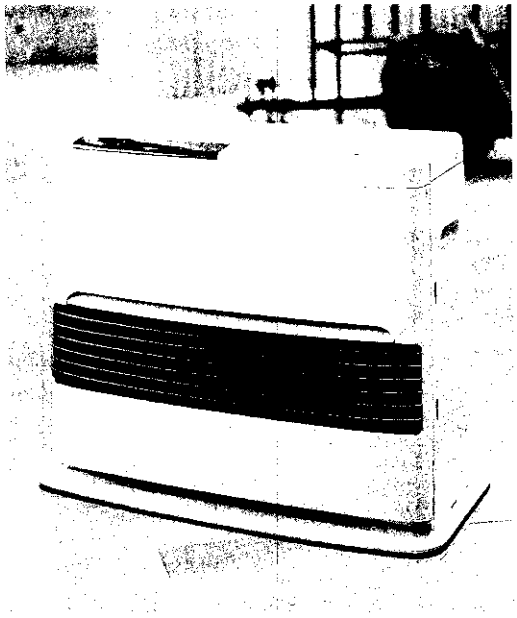

Photo 2 NONVIBRA applied to Mitsubishi fan heater (by courtesy of Mitsubishi Electric Corp.)

5 Concluding Remarks

NONVIBRA® vibration damping steel sheet offers the following characteristics:

(1) High vibration damping property.
(2) Wide product lineup allowing selection of the most appropriate material for operating temperature and strength.
(3) High heat resistance enduring coating and baking processes.
(4) The same weldability as that of an ordinary cold rolled steel sheet

References

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