

**Abstract:**

*“ECO FRONTIER JN” is an environment-friendly chromate-free functional coated steel sheet for electrical appliances which was developed by JFE Steel in response to environmental needs. By developing an organic composite coating consisting of a original organic resin with a high barrier effect and inorganic inhibitors with a self-healing effect, JFE realized high corrosion resistance with a thin flm for the frst time in the world and succeeded in satisfying the mutual contradictory requirements of corrosion resistance and electrical conductivity. Because “JN” has excellent properties, which include corrosion resistance, corrosion resistance after alkaline degreasing, electrical grounding, weldability, anti-fngerprint property, and paint adhesion property, application in the internal parts of OA/AV equipment and electrical appliances is increasing. As related products, JFE Steel has also developed and commercialized various other functional chromate-free steel sheets in the “ECO FRONTIER” series which provide higher levels of corrosion resistance, formability, paint adhesion, lubricity, and other properties.*

## **1. Introduction**

Chromate treatment of zinc-coated steel sheets is widely used as a low-cost rust-preventive treatment which suppresses corrosion of zinc. Since the 1980s, the needs for higher corrosion resistance and multifunctionality in materials have increased rapidly. In response, dry-in-place chromate-treated steel sheets with an anti-fingerprint property, paint adhesion property, lubricity, designability, and other features, and organic composite

coated steel sheets with a chromate flm and organic resin thin coating (1–2  $\mu\text{m}$  level or thinner) have been developed and are used widely in home electrical appliances and other products<sup>1)</sup>.

On the other hand, with heightened environmental protection activities, there have also been increasing moves to reduce the use of environmental load substances. In Europe, prohibited substances (Pb, Cr(VI), Cd, Hg, etc.) which are contained in electrical and electronic equipment are regulated under the EU’s directive on restrictions of the use of certain harmful substances, which will become effective in July 2006<sup>2)</sup>. Similarly, in Japan, major makers of electrical appliances and OA equipment have adopted “Green Procurement” policies which require purchasing in consideration of the environment, and are attempting to reduce the use/release of environmental load substances as part of these efforts. These various trends have led to expanded use of chromate-free materials and products





tivity due to its thin film thickness. In recent OA/AV equipment, there has been a tendency to attach importance to electromagnetic wave shielding characteristics. “JN” is also suitable for applications of this type.

In addition to the above, “JN” is a multifunctional chromate-free steel sheet which also offers excellent performance in the anti-fingerprint property and paint adhesion property.

This technology was awarded the Technology Award for 2002 by the Surface Finishing Society of Japan<sup>7)</sup>. In the citation, JFE Steel received extremely high evaluations for the originality and progressiveness of the technology, based on the fact that the company “realized high corrosion resistance with a thin film and succeeded in satisfying the mutually contradictory requirements of corrosion resistance and electrical conductivity/spot weldability at a high level by development of an organic composite coating with a high barrier effect,” and for the actual results of industrialization, in that it “succeeded

in industrialization and obtained a high evaluation from the market (OA equipment makers and others).” The results achieved with this product have also received a high evaluation from economic journals<sup>12)</sup>.

### 3. “ECO FRONTIER” Series

In addition to internal parts of OA/AV equipment and home electrical appliances, which are mainly used unpainted, chromate-free steel sheets for electrical appliances are also used after painting, as in the outer panels of refrigerators, washing machines, and showcases, and in applications such as motor covers and oil pans for oil fan heaters, high formability is considered necessary. JFE Steel therefore developed the high barrier effect and self-healing effect of “JN” to a new line of related products called the “ECO FRONTIER” series in order to answer these wide-ranging needs with environment-friendly chromate-free steel sheets.

**Table 1** shj2e



