

Metal sheet which expresses multiple emotions

Metallic sheets with multi-emotional features

Patent title	Electroless plating solution and electroless plating method	Inventor	Korea Institute of Materials Science / Yi Ju-yeol and four more
Patent application No.	KR 10-2017-0121488 (2017.09.20) / 10-2036334(2019.10.18)	Authority status	Registered
Patent title	Metal member having colored surface and method for coloring surface of metal	Inventor	Korea Advanced Institute of Science and Technology / Byun Ji-young and five more
Patent application No.	KR 10-2019-0040991 (2019.04.08) / 10-2215030(2021.02.04)	Authority status	Registered
Patent title	Warm-sensitive metal architecturing plate material and method for producing same	Inventor	Korea Institute of Industrial Technology / Park Jae-young and three more
Patent application No.	KR 10-2019-0155127 (2019.11.28)	Authority status	In an application process

Technicality

Technology overview

A multi-emotional expression metal sheet technology in which: the limitations of cold and hard metal materials are overcome and control is performed in a surface texturing and porous structure with a warm and soft sense to improve mechanical durability and structural performance; and a heat conduction and tactile control plating technology of a metal surface, a metal surface nano-coloring technology, and a texturing and continuous production technology are applied so that the texture, color, and tactile sensations of metal materials can be achieved.

Development background and problem to be solved

- Due to the limitation of color achievement by the existing organic solvent coating, the lack of responses to the B2C industry due to mass-production, and the lack of realization of various colors and tactile sensations, it is necessary to develop metal sheets and develop a convergence technology that can meet the needs of consumers.
- It is possible to apply the metallic luster to a metal surface or non-metal (plastics) by expressing the splendid and vivid color of the metallic luster, and to control the conversion of the tactile sensation of a metal material into a warm and soft characteristic through the microstructure control of a metal and a fusion between materials.

Excellence and discrimination of technology

Excellence of technology

- A color achievement technology of a vivid single color of metallic luster using a Metal-Insulator-Metal (MIM) structure
- A texture achievement technology of a micro pattern natural tactile metal replica plating technology
- A metal sheet heat conduction and tactile control technology using porous composite plating
- A tactile sensation achievement technology of a surface texturing technology and a thermal conductivity control technology

Discrimination of technology

- The natural pattern precision replication accuracy of 95% (an electroforming pattern replication rate) is achieved, natural tactile pattern resolution is 10 μm or less, and an imprinting pattern replication rate is 85%.
- The lowest thermal conductivity of a natural patterned texture is 1 W/mk or less, and 25% or more control compared to apparent elastic deformation based on mid-level leather.
- The sense of warmth and elasticity is enhanced by achieving metal foil architecturing with a surface texture.
- All colors are achieved with more than seven plasmonic colors (based on 4 inches), and nano-structured colors are expressed with PVD.

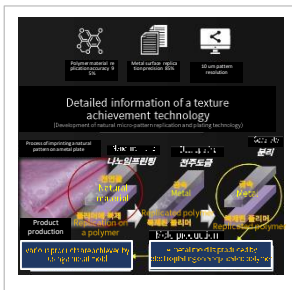
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Implementation method

According to the present invention,

- (Texture) A metal sheet having a natural tactile surface is produced by rolling a metal sheet using a roll for imprinting from a rigid Ni metal mold produced by electroplating.
- (Color) A type and a thickness are adjusted by using an MIM structure of an upper metal layer, a dielectric layer, and a lower substrate layer, and thus a substrate is changed to change the reflectance. Thus, a color can be controlled, and eighteen chromatic colors are achieved.
- (Tactile) The flexible characteristics of a metal foil composed of a micro texture are optimized, and a laminated structure is achieved by vertical crossing of eight pieces so as to secure durability and reliability through mechanical property evaluation.



Picture 1 Texture achievement technology



Picture 2 Color achievement technology



Picture 3 Tactile achievement technology

Degree of technology completion (TRL)

Degree of technology completion: TRL4-5 (Lab Scale prototype development and implementation environment application experiment stages)

TRL1	TRL2	TRL3	TRL4	TRL5	TRL6	TRL7	TRL8	TRL9
Technical principle presentation	Technology concept setting	Technology concept verification	Lab Scale prototype development	Implementation environment application experiment	Full Scale prototype development	Quasi-commercial product development	Commercial product development	Commercial product implementation

Utilization

Utilization field and applied product

Utilization field

- Building interior material and finishing material
- Vehicle interior material (surface metal pattern)

Natural patterned metal plate



Picture 1 Natural patterned metal plate material

Applied product

- Natural patterned metal plate material
- Various logos such as vehicle emblems
- Metal card



Picture 2 Various logos and metal cards

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Technology trend

- In the case of metal materials, the possibility of the success in developing metal sheet materials which express multiple emotions as an emotional design material that can satisfy the emotional needs of consumers is expected to increase in the future.
- An existing color achievement metal panel technology was used as materials for construction and home appliances and steel plates for vehicles. In addition to satisfying the human senses to overcome limitations such as lacks of various colors and tactile sensations and mass-production, an emotional design materials according to product competitiveness and industrial trends need to be developed.
- The market has been formed and grown mainly in Korea and Japan, and patent applications for sensitive metals have been increasing remarkably since 2013. Many applications have been made from Union Steel, Dongbu Steel, and Hyundai Hysco.

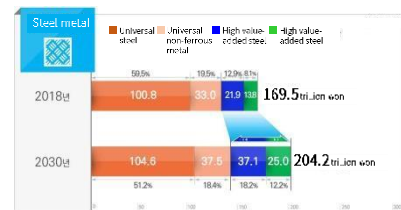
Family patent status

Application nation	Application No. (Application date) / Registration No.	Title of the invention
KOR	KR 10-2017-0121487 (2017.09.20)/ 10-2036329(2019.10.18)	Electroless plating solution, electroless plating method, and plating layer formed by using same
KOR	KR 10-2018-0071534(2018.06.21)/ 10-2117840(2020.05.27)	Roll stamp for imprint device, and production method (plating) thereof
KOR	KR 10-2018-0071553(2018.06.21)/ 10-2109913(2020.05.06)	Roll stamp for imprint device, and production method (casting) thereof
KOR	KR 10-2017-0154155(2017.11.17)/ 10-1979321(2017.11.17)	Color coating layer including metal particles, and production method thereof
KOR	KR 10-2019-0035380(2019.03.27)/ 10-2187068(2020.11.30)	Color pattern structure and production method thereof
KOR	KR 10-2018-0149036(2018.11.27)/ 10-2150888(2020.08.27)	Method for producing metal substrate material having color including metallic luster, and metal substrate material produced by same
KOR	KR 10-2019-0155168(2019.11.28) – in an application process	Elastic sense metal architecturing plate material, and production method thereof

Market prospect

Target market size and prospect

The global metal materials market is projected to grow from USD 140 billion in 2016 to USD 180 billion in 2021. In particular, in the case of steel and aluminum, which are representative metal materials, growth is remarkable mainly in the Chinese market. It is expected to record a high growth (6.0%) compared to a CAGR (5.5%) of the global metal material market. The domestic market size was KRW 42 trillion in 2015, accounting for about 3% of the global market, and the ceramic material component industry is expected to continue to grow due to the rapid growth of new growth engine industries following the market expansion of high-performance materials.



Picture Changes in the steel and metal industry

<Data: Manufacturing Renaissance Vision and Strategy (Interagency, 2019)>

Technology transfer query



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Technology transfer process

