This application is a continuation of my patent application Serial No. 97,153, filed March 21, 1961, now abandoned for Electrolyte for Use in the Galvanic Deposition of Bright Leveling Coatings. This invention relates to an electrolyte for use in the galvanic deposition of bright leveling coatings.

The application of bright nickel plating has in recent years been the subject of numerous new inventions. This is evidence of the interest displayed in the art of producing decorative surface finishes; nickel undercoats which serve as a foundation for high-quality, bright chromium plating which itself contributes nothing towards the production of bright surfaces, have come into general use and are found to be satisfactory.

Great advances in this direction have been made by the development of so-called leveling baths, i.e., of electrolytes which more or less effectively level the grinding and polishing scratches usually present prior to the application of the electroplating; these being thereby produced, in exceptional cases, surface finishes which already very closely approach the appearance of a highly polished surface.

In addition to the purely decorative effect thereby obtained, such baths further offer the great advantage of enabling a reduction of the grinding and polishing costs which form such a high proportion of the total cost of production.

High efficiency baths of the kind just mentioned should, however, not merely offer advantages in decorative effect and production efficiency, but should also be capable of contributing to the protection of the foundation material from corrosive influences.

A problem from the question of whether the corrosion protection can be afforded, for example, by a crack-free chromium coating, the homogeneity of the underlying nickel coating must be admitted to play a decisive part in determining the corrosion resistance of the electroplated material; if, for instance, the nickel undercoating is porous, the chromium coating will not even begin to form in such places.

This effect of the formation of pores is frequently observed in baths intended for the deposition of coatings with the highest leveling effect. In addition, the majority of the brightening or polishing agents hitherto used have the disadvantage that they themselves and their products of decomposition are not always easily removable from the electrolyte in the event of a stoppage in the production line.

The substances hereinafter proposed are characterized in that, besides having a high brightening and smoothing power, they very reliably guarantee the formation of non-porous deposits or coatings.

The brightening and leveling agents contained in the proposed electrolyte composition are characterized by the following elementary structure.

The basic ingredient is a heterocyclic nitrogen compound of the type of pyridine, substituted at the nitrogen atom by groups essentially characterized by the presence of groups forming 1½ to 2 fold bonds as a consequence of resonance. Cf. e.g., H. A. Staab, “Einführung in die theoretische Organische Chemie” (Introduction to Theoretical Organic Chemistry), Verlag Chemie, 1959, pp. 63 et seq., further, p 80, and in particular pp. 92 and 93. Such substances as contemplated by the present invention are, for instance, the following halides:

### Example I

<table>
<thead>
<tr>
<th>Substance</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel sulphate</td>
<td>240-300 G/l</td>
</tr>
<tr>
<td>Nickel chloride</td>
<td>30-60 G/l</td>
</tr>
<tr>
<td>1-Phenacyl-pyridinium iodide</td>
<td>0.05 G/l</td>
</tr>
<tr>
<td>Saccharine</td>
<td>0.1-4 G/l</td>
</tr>
<tr>
<td>Sodium lauryl sulphate</td>
<td>0.1-1 G/l</td>
</tr>
<tr>
<td>pH value, 2.5-4.8</td>
<td>Temperature, 45°-60°C</td>
</tr>
</tbody>
</table>

### Example II

<table>
<thead>
<tr>
<th>Substance</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel sulphate</td>
<td>240-300 G/l</td>
</tr>
<tr>
<td>Nickel chloride</td>
<td>30-60 G/l</td>
</tr>
<tr>
<td>Boric acid</td>
<td>25-40</td>
</tr>
<tr>
<td>Benzy1-pyridinium chloride</td>
<td>0.02-0.5</td>
</tr>
<tr>
<td>Saccharine</td>
<td>0.15-4.5</td>
</tr>
<tr>
<td>Lauryl sulphate</td>
<td>0.1-1</td>
</tr>
<tr>
<td>pH value, 2.5-4.8</td>
<td>Temperature, 45°-60°C</td>
</tr>
</tbody>
</table>

Development has shown that the structural principle can be varied in a particular manner whereby, depending on the specialized structure of the compounds, some latitude in the individual characteristics of the electrolytes and the deposits is possible. This enables further improvements to be gained in addition to those already described, in regard to brightness, leveling and homogeneity of the deposits.

It was also found the structural types could be further extended in different ways, whereby equally satisfactory results were obtainable.

Particularly homogenous nickel coatings can, for instance, be obtained if the substitution of the nitrogen atom in the heterocyclic ring containing groups with 1½ to 2 fold bonds is further chained, the chain having to contain at least 6 atoms.

The substances are used in combination with already known secondary brighteners. Suitable wetting agents are the sulphation compounds of the higher alcohols.

Electrolytes of the composition stated furnish, within a range of pH 2 to 5, at 40-70°C temperature, and with current densities up to 10 amps/dm², high-brilliance, levelled and homogeneous nickel coatings. This electrolyte uses a heterocyclic nitrogen compound of the pyridinium type, substituted at the nitrogen atom by a carbon chain, of the type specified in the combination given above.

The process of making phenacyl-pyridinium-iodide is disclosed in Houben-Weyl, volume XI/2, page 609, or...
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L. C. King, Am. Soc. 66, 894 (1944), by the transference of acetophenone, iodine and pyridine. The process of making benzyl-pyridinium-chloride may be found in Beilstein II, 20, page 135, which was obtained from G. D. Seytschew (Chem. Zentralblatt, 1930, I, 2654), using the reaction of 2 ml. of benzylchloride and 1.3 ml. of pyridine in alcohol. The oil which remains after the evaporation of alcohol crystallizes in the presence of sulfuric acid. The crystals contain two molecules of water of crystallization.

I claim:

1. An electrolyte for the deposition of mirror-bright nickel coatings having surface leveling effects comprising an acid aqueous solution of nickel material supplying nickel ions and consisting essentially of a composition selected from the group consisting of nickel sulfate aqueous solution, nickel chloride aqueous solution and nickel sulphate and nickel chloride aqueous solution and including from 0.02 to 0.5 gram per liter of a compound represented by the formula

\[
\begin{array}{c}
\text{N}^+ - \text{R} \\
\text{Z}
\end{array}
\]

wherein

\[
\begin{array}{c}
\text{N}^+
\end{array}
\]

represents the unsubstituted heterocyclic radical pyridinium, \( R \) represents a monovalent N-substituent selected from the group consisting of

\[
\begin{array}{c}
\text{OH}_2 - \text{C}
\end{array}
\]

and

\[
\begin{array}{c}
\text{OH}_2 - \text{C}
\end{array}
\]

and Z is halogen.

2. An electrolyte as defined in claim 1, including a known brightener.

3. An electrolyte as defined in claim 1, in which the heterocyclic compounds is N-phenacyl pyridinium iodide.

4. An electrolyte as defined in claim 1, in which the heterocyclic compound is benzylpyridinium chloride.

References Cited by the Examiner

UNITED STATES PATENTS

- 2,800,441 7/57 Brown 204—49
- 3,008,883 11/61 Passal 204—49
- 3,054,733 9/62 Heiling 204—49

JOHN H. MACK, Primary Examiner.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,206,383

September 14, 1965

Mario Käppel

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, lines 9 and 10, for that portion of the formula reading

\[ \text{CH}_2^- \quad \text{read} \quad \text{-CH}_2^- \]

line 15, for "compounds" read -- compound --.

Signed and sealed this 5th day of April 1966.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents