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Detailed Work Instruction for Electroplating Non-Conductive Parts
This instruction describes the professional electroplating of non-conductive substrates such as glass, plastics, GRP/CFRP, and 3D-printed parts. It fully integrates your provided process description and expands it with technical details, best practices, and safety guidance.

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1. Scope and Objective

The objective is to make non-conductive surfaces electroplatable by applying a conductive coating (conductive paint) and subsequently building up a mechanically stable, glossy copper layer, followed optionally by further metallic layers (nickel, silver, gold, etc.).

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2. Materials and Equipment

2.1 Substrates

- **Glass**
- **Plastics (ABS, PLA, PETG, PA, PC, etc.)**
- **GRP / CFRP**
- **3D-printed parts (FDM, SLA, SLS)**

2.2 Chemicals and Consumables

- **Copper conductive paint or silver conductive paint**
- **Acid copper electrolyte (bath copper or PP copper)**
- **Optional: 10% sulfuric acid (H_2SO_4)**
- **Degreasing agent (isopropyl alcohol, acetone* depending on plastic)**
- **Sandpaper grit 400–600 (surface prep), 2000–3000 (activation)**
- **Deionized water**

2.3 Electroplating Equipment

- **Regulated DC power supply (stable output)**
- **Electrolyte tanks (chemically resistant)**
- **Electrodes:**
    - **Bath plating: copper plate electrodes**

    - **Brush / tampon plating: rod electrode Ø 6 mm**
- **Suspension and electrical contacts (copper wire, clamps)**
- **Gentle agitation or solution movement (recommended)**

2.4 Personal Protective Equipment (PPE)

- **Chemical-resistant gloves**
- **Safety goggles**
- **Acid-resistant apron**
- **Adequate ventilation / exhaust**

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3. Substrate Preparation

3.1 Mechanical Surface Preparation

1. **Lightly roughen the surface to improve adhesion:**
    - **Smooth plastics / glass: sandpaper grit 400–600**
2. **Remove all sanding dust thoroughly.**

3.2 Degreasing

1. **Thoroughly degrease the surface using a suitable solvent.**
2. **Rinse with deionized water.**
3. **Allow to dry completely.**

Note: Residues from release agents (especially on 3D-printed parts) are a very common cause of adhesion failure.

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4. Application of Conductive Paint

All non-conductive surfaces can be electroplated as follows:

4.1 Selection of Conductive Paint

Silver conductive paint

- **Higher cost**
- **Very reliable and high conductivity**
- **No activation required**

Copper conductive paint

- **More economical**
- **Forms an oxide/patina after drying**
- **Requires activation prior to plating**

4.2 Application

1. **Apply the conductive paint very thinly and evenly:**
    - **Preferably by airbrush**
    - **Alternatively by spray can**
2. **Several thin coats are better than one thick coat.**

3. **Define and reinforce the electrical contact point.**

4.3 Drying

- **Allow the conductive paint to fully cure:**
  - **Not only surface-dry**
  - **Must be well bonded to the substrate**
- **Follow manufacturer curing times (often several hours up to 24 h).**

Important: Insufficiently cured conductive paint may detach in the electrolyte.

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5. Activation of Copper Conductive Paint

Because copper conductive paint oxidizes after drying, activation is required:

5.1 Activation in Copper Electrolyte (recommended)

- **Immerse the part in acid copper electrolyte for approx. 20 minutes without current**
- **The acid removes the oxide layer**

5.2 Alternative Activation Methods

- **Brief treatment with 10% sulfuric acid**
- **Very light sanding using 2000–3000 grit sandpaper**

After activation:

- **Rinse with deionized water**
- **Avoid touching the surface (finger grease!)**

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6. Copper Electroplating (Base Build-Up)

6.1 Plating Methods

- **Bath plating (uniform, thicker deposits)**
- **Brush / tampon plating (localized areas, small parts, repairs)**

6.2 Bath Plating Setup

1. **Select a tank large enough to fully immerse the part.**
2. **Use 1–4 copper plate electrodes, depending on tank size.**
3. **Distance between electrodes and part: approx. 10 cm.**
4. **Ensure secure and conductive electrical contact to the part.**

6.3 Process Parameters (Guideline Values)

- **Start with low current density, increase slowly**
- **Voltage depends on bath chemistry and geometry**
- **Temperature according to electrolyte supplier**
- **Plating time: long and intensive until a**
  - **closed**
  - **glossy**

- mechanically stable copper layer is achieved

The goal is not only conductivity, but sufficient layer thickness and adhesion.

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7. Further Plating / Barrier Layers

After copper build-up, the following options are available:

7.1 Hard Barrier Layers (recommended)

- **Nickel**
- **Palladium**
- **Cobalt**

These layers prevent diffusion, oxidation, and significantly improve wear resistance.

7.2 Direct Finishing on Copper

- **Silver plating**
- **Gold plating**
- **Black nickel plating**

Copper can be plated directly, but a barrier layer greatly improves long-term stability.

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8. Suitable Electrodes

- **Brush / tampon plating: rod electrode Ø 6 mm**
- **Bath plating: copper plate electrodes**

Electrodes should be cleaned regularly to avoid passivation.

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9. Typical Errors and Practical Notes

- **Insufficient degreasing → poor adhesion**
- **Conductive paint applied too thick → peeling**
- **Excessive current density → rough or burnt deposits**
- **Poor electrical contact → uneven plating**

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10. Safety Notes

- **Acids and electrolytes are corrosive**
- **Never add water to acid**
- **Rinse splashes immediately with plenty of water**
- **Store chemicals properly labeled and out of reach of children**

Equipment:

Bezeichnung
Kupfer- oder Silberleitlack: https://real-gold.de/Produkte/Leitlacke-nicht-leitende-Flaechen/ Saures Kupfer https://real-gold.de/Kupfer-sauer-Glanzkupfer-Elektrolyt/BMG-095M PP Kupfer: https://real-gold.de/PP-Kupfer/BMG-130M 25 A Netzteil regelbar https://real-gold.de/Galvanikgeraet-Laborgeraet-regelbar/BMG-25A
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Entfetter https://real-gold.de/Elektrocleaner-Entfetter/SW10002.5M

Aktivator https://real-gold.de/Aktivator/BMG-061.3M
Nickel Free oder Nickel Strike https://real-gold.de/Nickel-Free/BMG-091M Gold: https://real-gold.de/Gold-Elektrolyt-8-Gramm-L.-Gold/BMG-067M

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