2.2. General Applications

2.2.1 Normal Conductors

A world without *conductors* is even harder to imagine than a world without *semiconductors*. Examples for applications include

- High-voltage free-air power transmission lines.
- High voltage wires for trains (getting "scratched" all the time).
- In-house wiring.
- Low-voltage wiring (car systems).
- High current wiring (machines).
- System on-board wiring.
- Bond wires for ***IC***'s (diameter **< 30µm**).
- Metallization on chips.
- Screening electrical or magnetic fields.
- Avoidance of electrostatic charging.
- Electrodes for batteries, chemical reactors etc.
- Antennas.

Each use has special requirements which should be met by the conducting material.

Some examples for requirements

- *Money* (Use of **Au**, **Ag**, **Pt** etc. may be critical).
- *Chemistry* (general stability and reactivity; esentiall excludes **Na**, **K**, **Hg** etc. for most applications; corrosion properties, ...).
- *Mechanical* properties (Pure metals are often too soft, but alloys have higher resistivity).
- *Thermal* properties (temperature coefficient; no metal usable beyond ca. **1000 K**) .
- *Compatibility with other materials* (contact corrosion, solderability, thermoelectric and thermomechanical properties, general chip compatibility, ...).
- *Compatibility with production technologies* (e.g. thin film deposition methods, wire making (try this with a brittle superconductor!),...).

Whole families of conductors, fine-tuned for a specific applications, were developed; below are some examples.

***Cu** based conductors*

There are many precisely specified **Cu**-based conductors for all kind of specific applications, examples are given in the link.

***Al** based conductors*

This family is primarily used for high-voltage free-air cables (in combination with a steel core) because of best fitting in terms of conductivity - price - mech. ***strength*** - corrosion requirements; cf. the illustration in the link.

Others

In *one* **IC** you may find the following conductor materials:

- Poly crystalline highly doped **Si**.
- Silicides; i.e. **Si** - metal compounds like **$NiSi_2$**.
- **Al** with $\leq$ **1%** of **Si** and **Cu** if the chip was made before, say, **2000**.
- **Cu** with some additions instead of **Al** if the chip was made after **2000**.
- **W**.
- **TiN**.

because one material simply does not meet the specific requirements for conductor on chips.