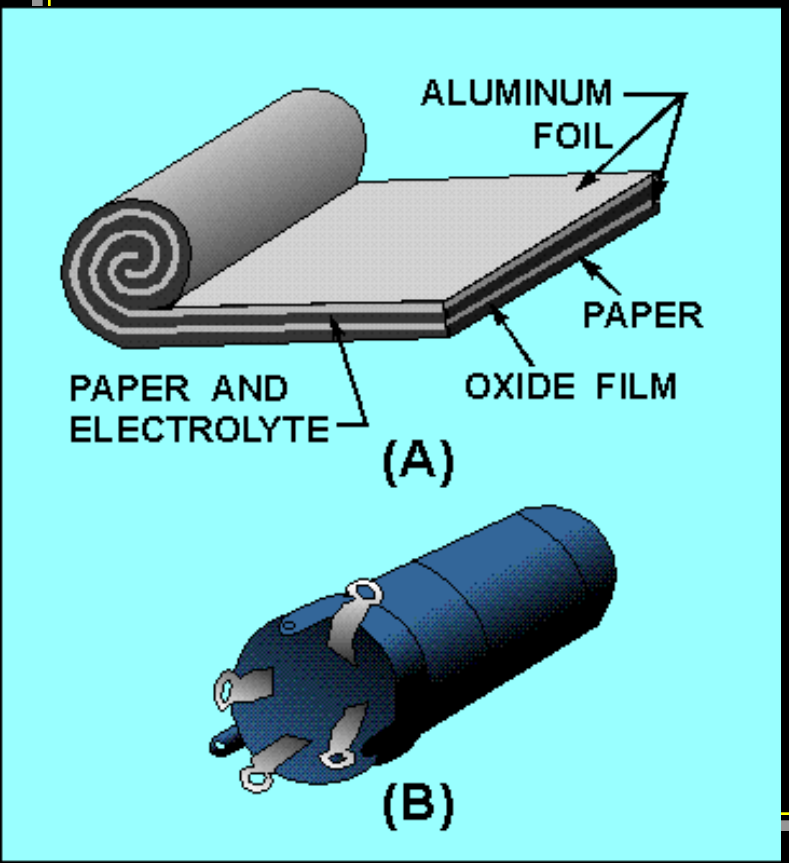
Shri Sant Gajanan Maharaj College of Engineering
Department of Electronics & Telecommunications Engineering

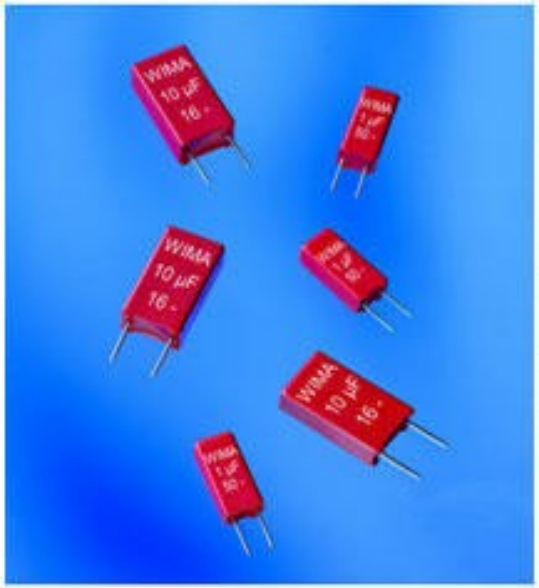
Electronic Devices & Components

Unit – I Resistors and Capacitors

Fixed Capacitors: Manufacturing Processes

Paper Capacitor





Paper capacitor

Oil-Impregnated paper capacitor

Characteristics of Paper Capacitor

- **Capacitance Range: 1000 pF to 500 µF**
- **Temperature Coefiicient:** ± 200 ppm / ^{o}C
- **Frequency Range: 1 kHz to 100 MHz**
- **Voltage Range: 600 V**
- **Temperature Range: -55** / ^{o}C **to +125** ^{o}C

Applications of of Paper Capacitor

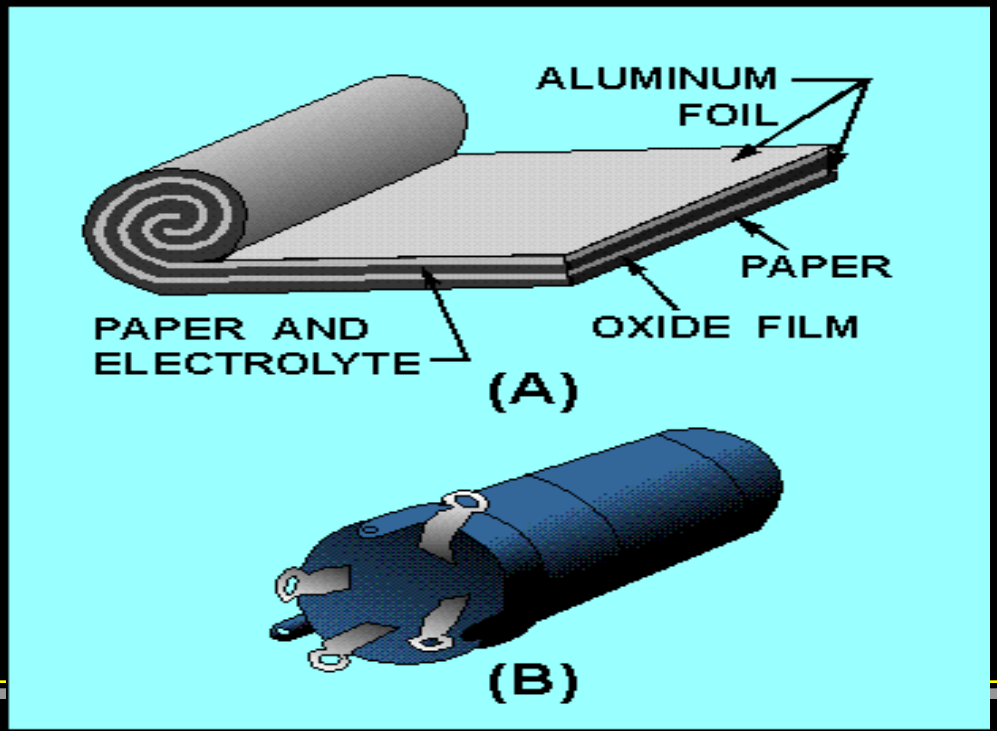
- Mains Surge Protection
- Starting electric motors

Manufacturing Process of Aluminum Foil Paper Capacitor

- Step -1 Dielectric Preparation: Kraft paper is used as dielectric which has thickness 7.5 µm to 25 µm. The paper is dipped in castor oil or mineral, wax and petroleum compounds. It is then dried.
- Step - 2 Cutting of Paper: The Kraft papers are cut in to long strips. The breadth of paper is kept in range of few millimetre to 4 cm

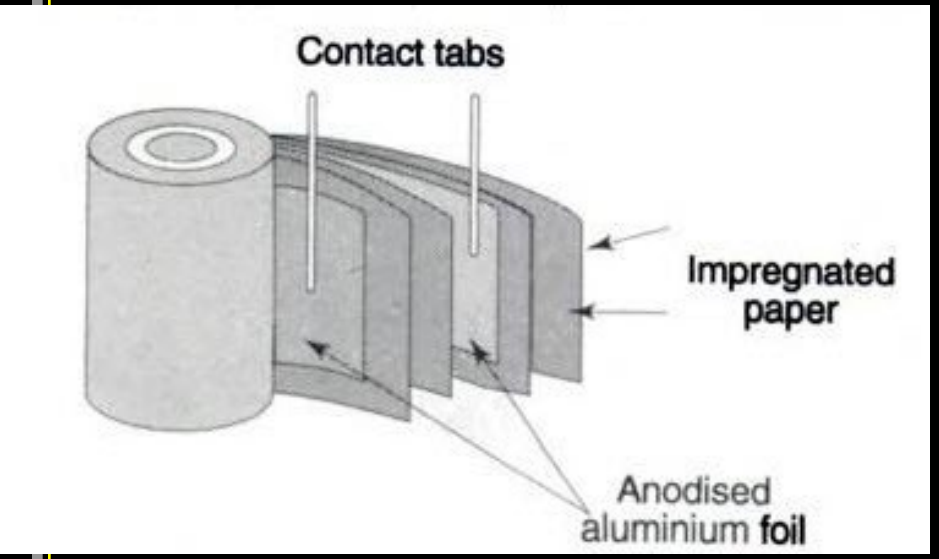
Manufacturing Process of Aluminum Foil Paper Capacitor

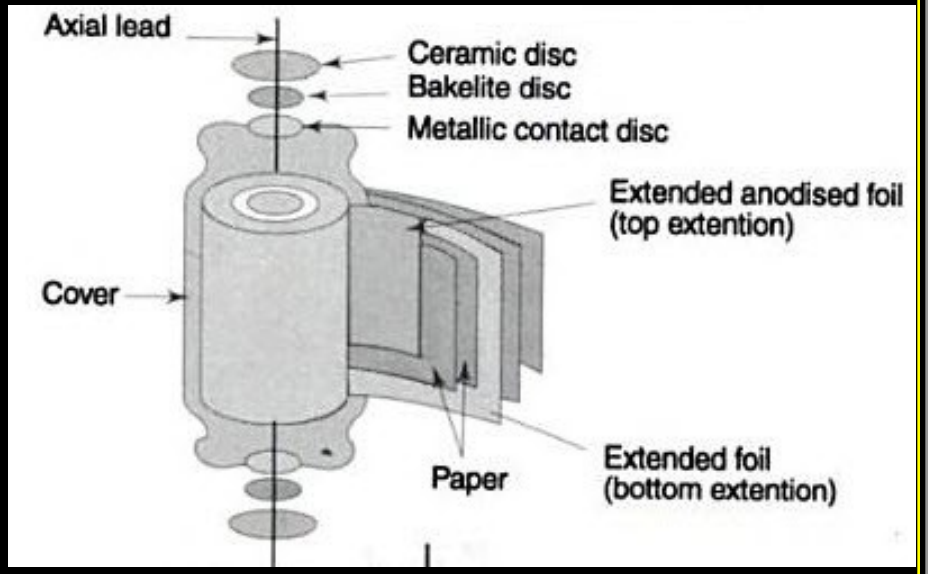
- Step -3 Preparing Roll: Two aluminum foils are cut of same length and breadth of as that of oil coated Kraft paper. Three layers of oil coated Kraft paper are placed between two aluminum foils and rolled together



Manufacturing Process of Aluminum Foil Paper Capacitor

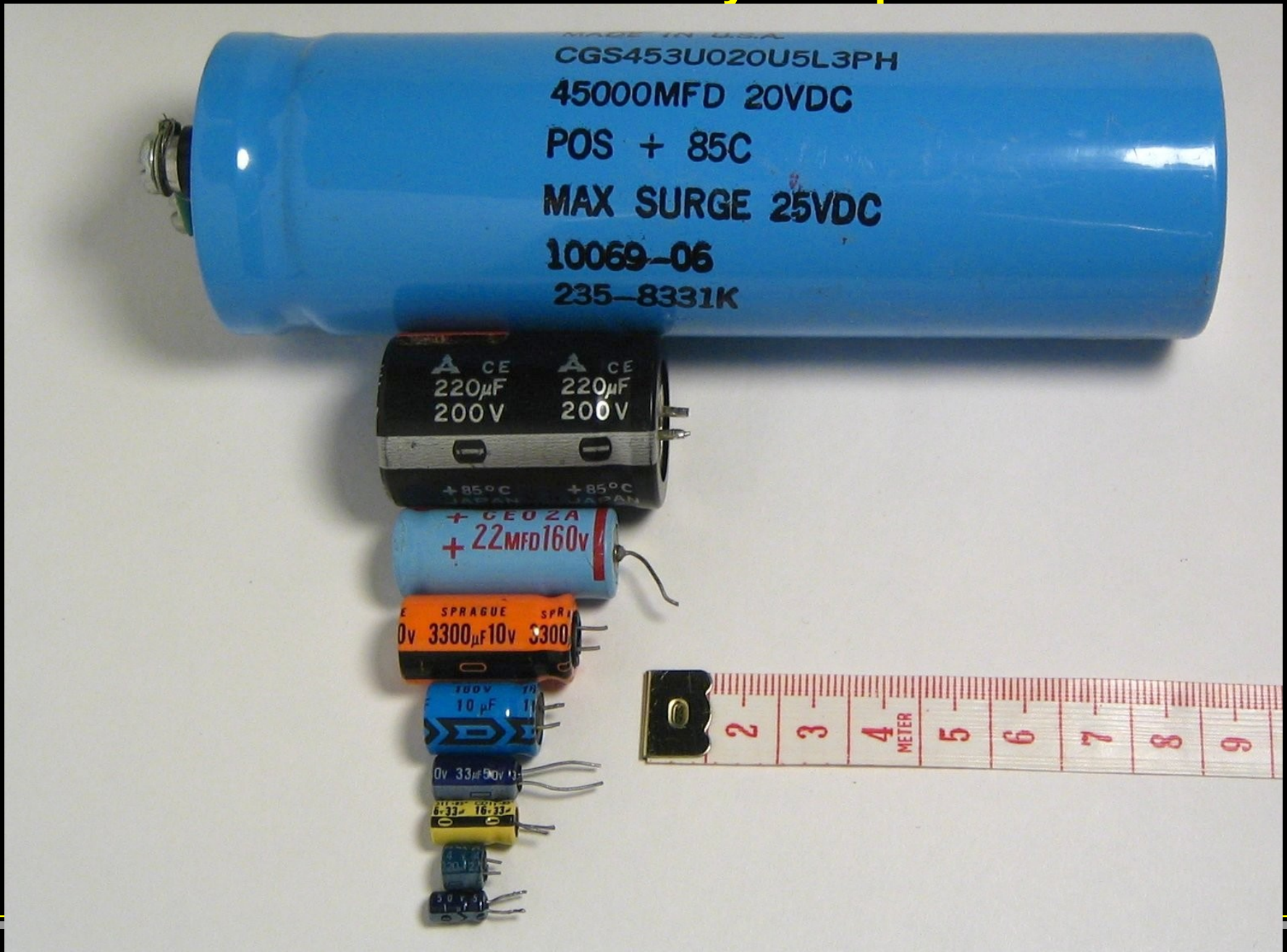
- Step -4 Connecting leads and Encapsulation: Contact leads are soldered to aluminum foils. The capacitor is encapsulated with plastic case or metal case





Radial Lead Paper Capacitor Axial Lead Paper Capacitor

Aluminum Electrolytic Capacitor



Characteristics of Electrolytic Capacitor

- **Capacitance Range: 1 µF to 1000 µF**
- **Temperature Coefficient:** ± 200 ppm / ^{o}C
- **Frequency Range: 1 Hz to 10 kHz**
- **Voltage Range: 35 to 75 V**
- **Temperature Range: -55** / ^{o}C **to +175** ^{o}C

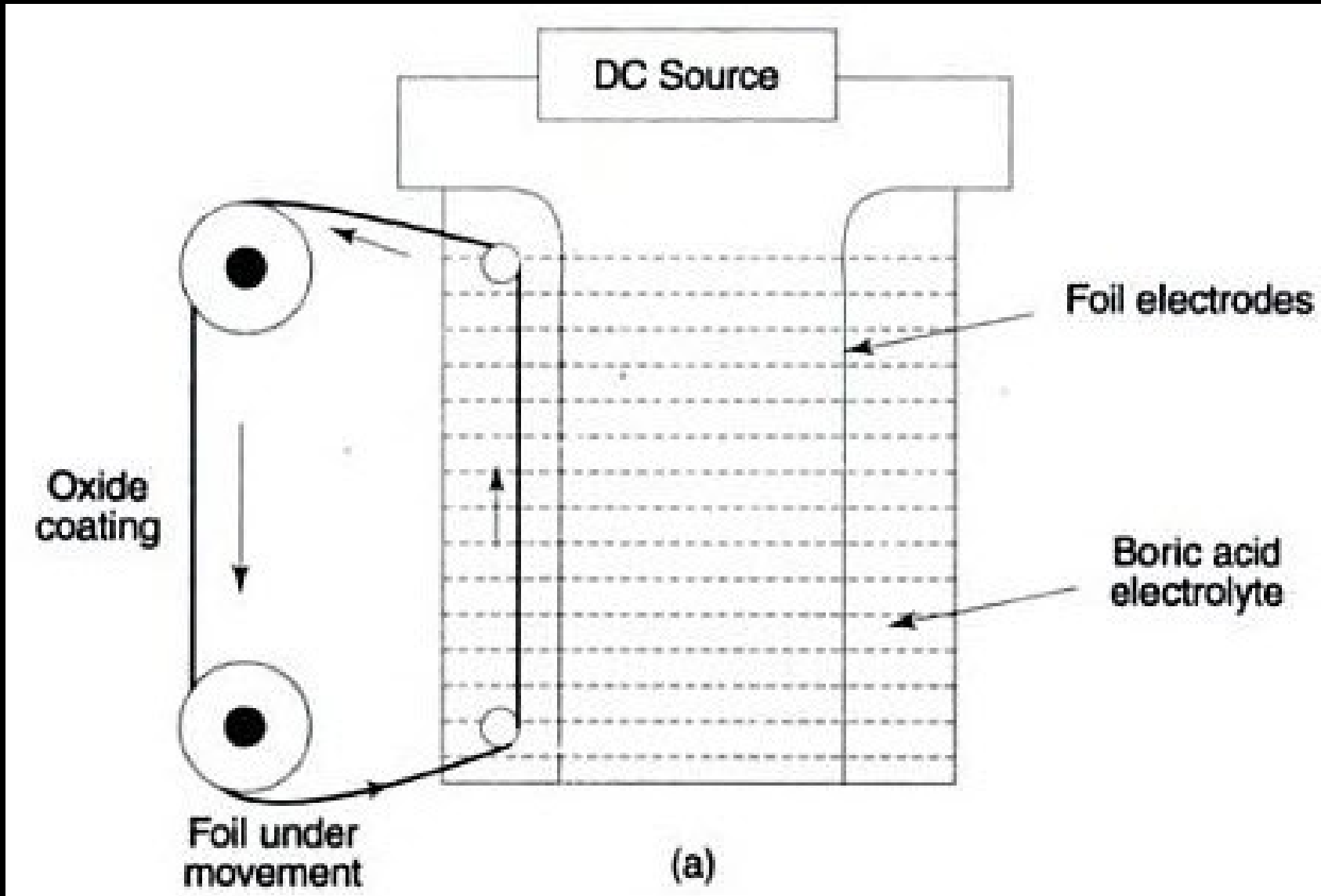
Applications of of Electrolytic Capacitor

- As bypass capacitors in amplifiers to increase gain
- As filter capacitor to smoothen ripples so that constant DC voltage is obtained
- Timing circuits such as square wave generators
- Coupling capacitors in amplifiers to pass AC and block DC

Manufacturing Process of Aluminum Electrolytic Capacitor

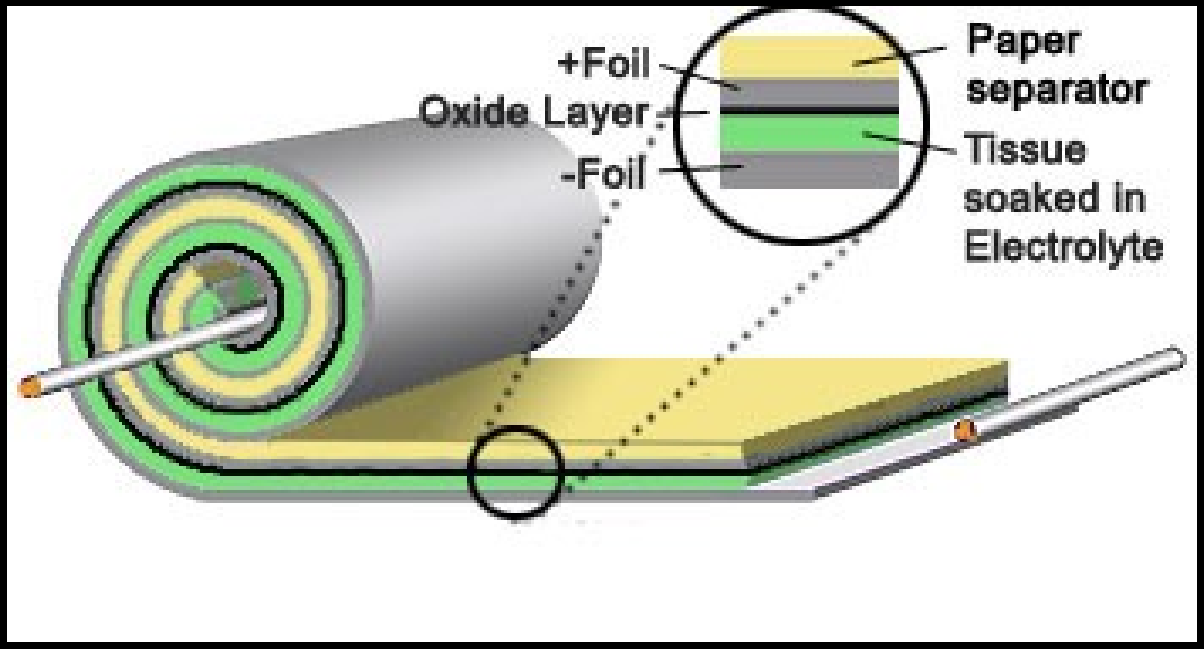
- Step -1 Preparation of electrolyte: Electrolyte made up of water, boric acid, glycol and ammonium metaborate is put in glass container. Two aluminum foil electrodes are dipped in it. The electrodes are made to revolve slowly through motors
- Step - 2 :Electroplating Process: DC Voltage slightly greater than desired rated voltage (3.3 V to 600 V DC) is applied to electrodes. Oxygen ions are released and they deposit extra electrons on anode and also form aluminum oxide layer. Aluminum oxide is a dielectric.

Manufacturing Process of Aluminum Electrolytic Capacitor

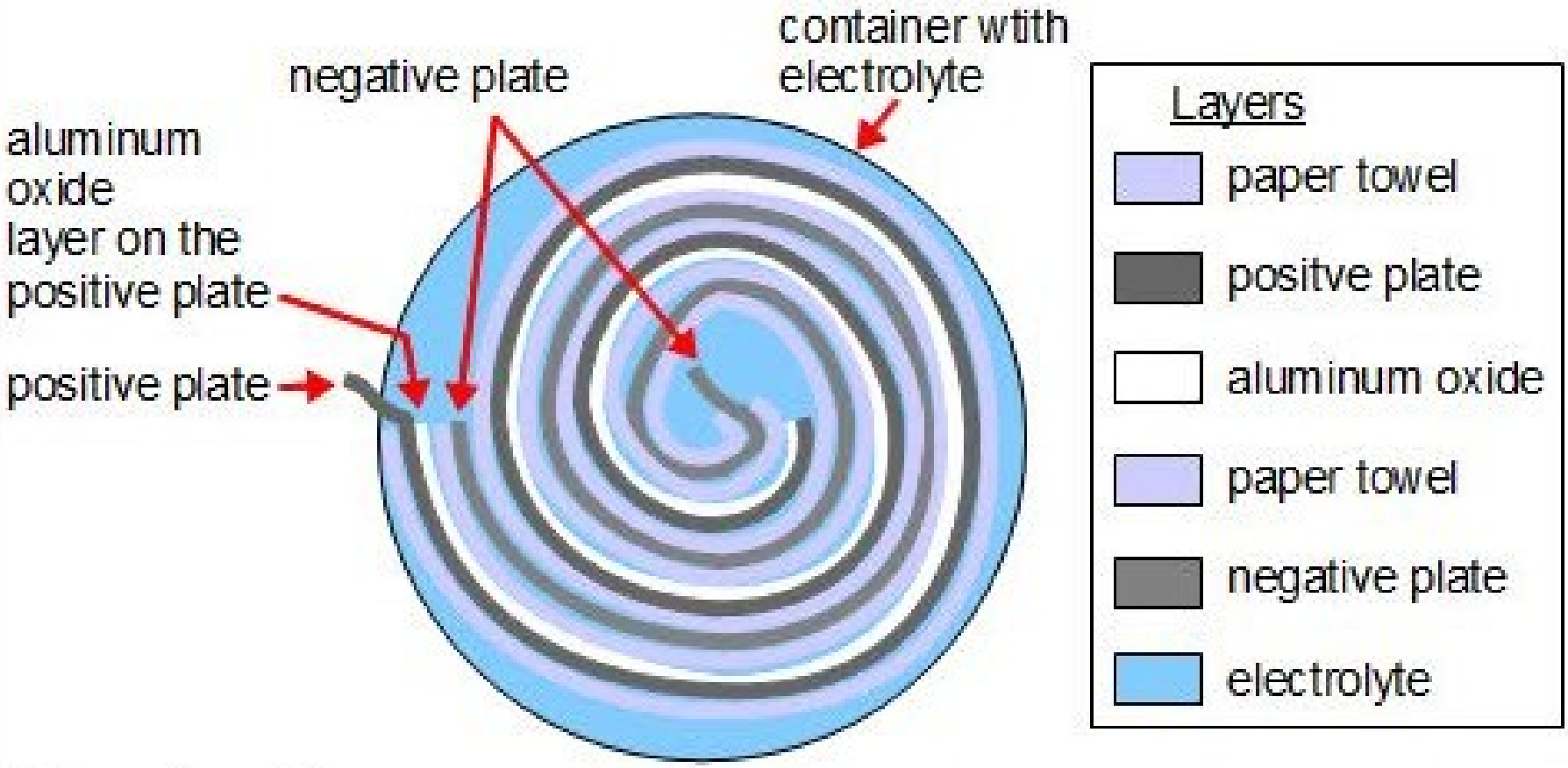


Manufacturing Process of Aluminum Electrolytic Capacitor

- Step -3 Preparation of Roll: One oxidized aluminum foil and one un-oxidized aluminum foil are taken. Two layers of Kraft paper are sandwiched between aluminum foils and rolled together

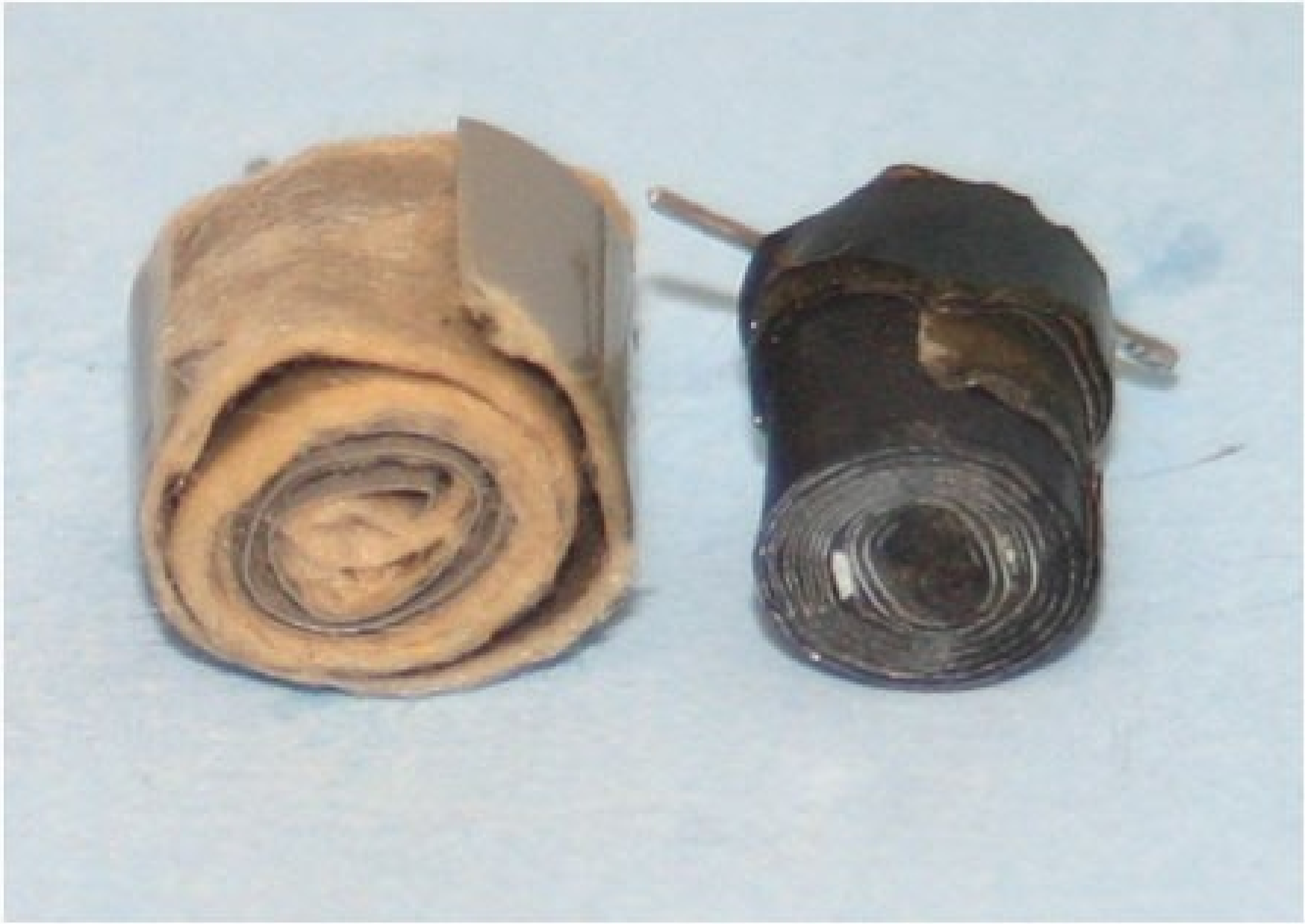


Manufacturing Process of Aluminum Electrolytic Capacitor



The number of turns may vary.

Manufacturing Process of Aluminum Electrolytic Capacitor



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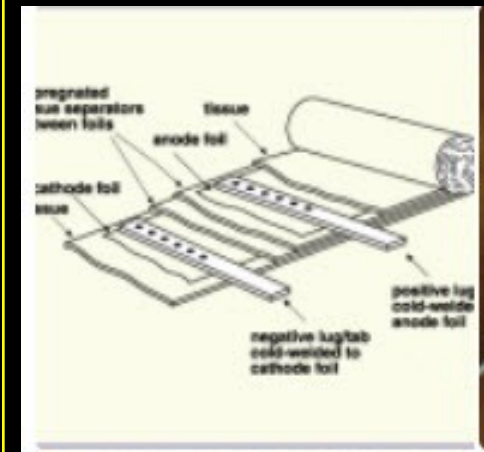

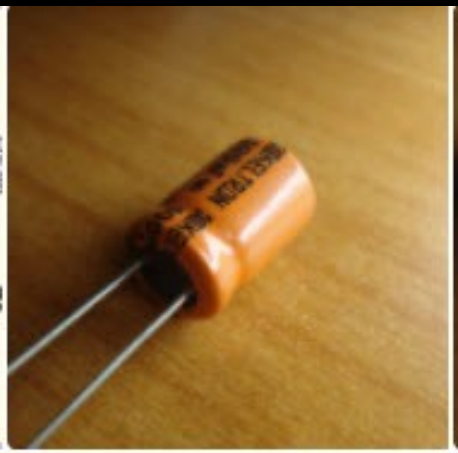

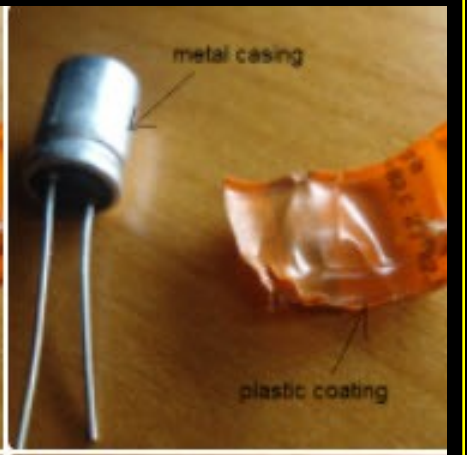

Manufacturing Process of Aluminum Electrolytic Capacitor

- Step -4 Encapsulation and Labeling: The assembly is housed in aluminum tubes. Capacitance value, Voltage rating and polarity of terminals are labeled

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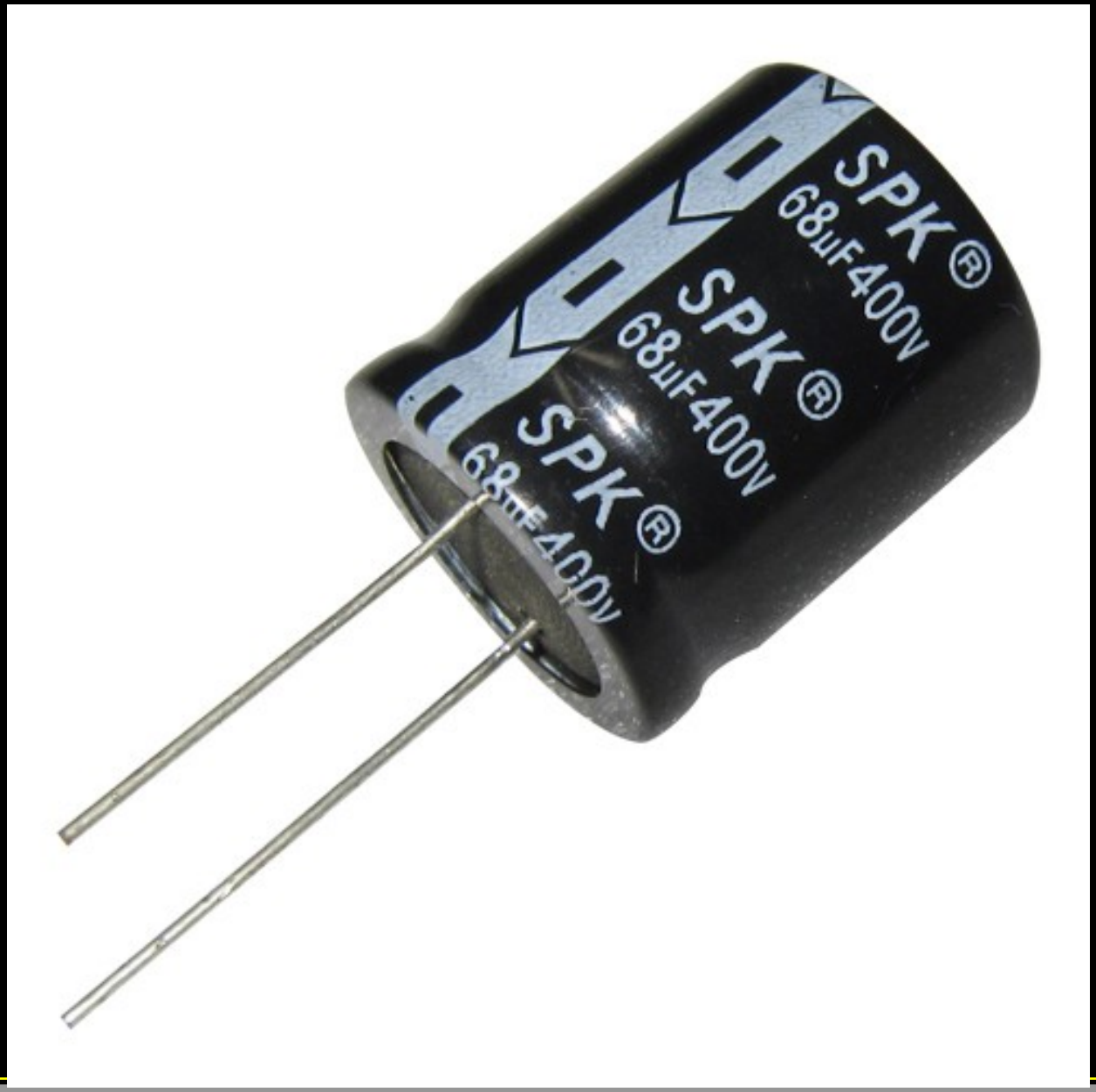

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