Chloriding Ag/AgCl Electrodes
Disk, Pellet, or Wire

Chloriding silver is a required step in creating a stable electrode for all electrophysiological applications. The fundamental premise says that the redox chemistry of chloride binding with the base metal is the transducer of the chemical current in solution into an electrical current in the wire. A well chlorided Ag^+ electrode can pass μA currents yet still remain stable for extended periods of time.

General precautions

1) To reduce contamination of the base metal, avoid touching the bare silver with your fingers.
2) When working with a disk or pellet electrode, hold the electrode body at the base of the of the silver wire to prevent breaking the pellet. Also avoid bending the wire more than necessary.
3) Ag/AgCl electrodes should not be mounted in direct or chemical contact with other metals. This will prevent undesirable side-reactions.
4) If needed, an epoxy adhesive can be used to mount the electrode onto an apparatus. For best results, epoxy or other encapsulants should have the following properties:
    - Paste-like viscosity after mixing
    - Good adhesion to surfaces
    - Good resistance to chloride solutions

Cleaning the Ag^+ wire before chloriding

The wire should be cleaned before chloriding.

An un-chlorided wire can simply be cleaned with EtOH and rinsed with H_2O before proceeding. A previously chlorided wire should be wiped with dilute HCl to remove the old coating, then rinsed in EtOH and H_2O.

Chloriding the Ag^+ wire

There are two methods in common use to chloride a silver wire. These are the putative electrical and chemical methods. Both work very well but the electrical method yields a deeper coating.

Electrical method

Electrical chloriding of Ag^+ wire is achieved by making it positive relative to a solution containing NaCl (0.9%) or KCl (1 M). One way to achieve this is to pass a current at a rate of approximately 1 mA/cm^2 for about a minute, or until the wire is adequately plated. (For example, to chloride a 2 cm length of a 0.25 mm Ag^+ wire (this is the diameter of the wire used in Warner electrode holders) requires 0.15 mA of current.)

The color of a well plated electrode will be light gray to a purplish gray. While plating, occasionally reversing the polarity for several seconds tends to deepen the chloride coating and yield a more stable electrode.

Chemical method

An alternate to the electrical method is to immerse the wire in Clorox bleach until a light gray color is observed (typically 10-15 minutes is sufficient). At a minimum, this simpler method is commonly performed at the beginning of each day's work.

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Cleaning pellet or disk electrodes

A pellet or disk electrode is different from a wire electrode in that it is sintered from a mixture of Ag^+ and AgCl material. Therefore, a disk or pellet does not need to be chlorided on a regular basis but can benefit from an occasional cleaning.

Clean by rinsing in EtOH and then by soaking in H_2O for a minute or so. I adeeper cleaning is required, then soak in dilute HCl for 30 seconds before rinsing.

Finally, if the electrode becomes especially dirty or corroded, then a new surface can be exposed by gentle abrasion. However, most often you will be better served by just replacing the electrode.

Conditioning disk and pellet electrodes

Sintered electrodes must be conditioned before first use to minimize DC offsets and to reduce the noise. This is achieved by joining the electrode wires together and immersing the pellets (or disks) in your electrolyte for several hours. This procedure both brings the plating of the electrodes into equilibrium and allows the interstitial solution phase (the solution within the body of the electrode) to equilibrate with the electrode body.

NOTE: When soaking multiple electrodes, short the ends all electrode wires to a common point.

NOTE: While results with different electrolytes are not predictable, experimentation will not damage the electrodes unless corrosive chemicals are used.

Cleaning after use

After most applications, rinse all electrodes (wire, pellet, or disk) with EtOH followed by distilled water to clean the surface.

Sterilization

When sterilization is required, only gas or liquid agents should be employed. Disinfectants containing mercury, phenols, bromine, iodine, zinc, tin, or organometallic compounds should be avoided. Do not autoclave mounted electrodes as most epoxies and cable insulations cannot withstand the temperatures of steam sterilization.

Darkening

Ag/AgCl is light-sensitive and exposure to light will darken the electrode surface. This will not impair the performance of disk or pellet electrodes since the interstitial Ag/AgCl matrix is not reached by light. Wire electrodes can be simply cleaned once the surface becomes compromised.

Temperature Limit

Silver-silver chloride electrodes can withstand temperatures up to 2000°C. Lower temperature limits should be imposed if the electrodes are used with adhesive or encapsulating materials.

Storage

Bare electrode pellets and disks should be handled with care. Do not store electrodes in contact with metals, especially active metalics such as iron or aluminum. Also, substances that could affect the electrochemical characteristics of the materials used should be avoided. Electrodes should be stored clean and dry.