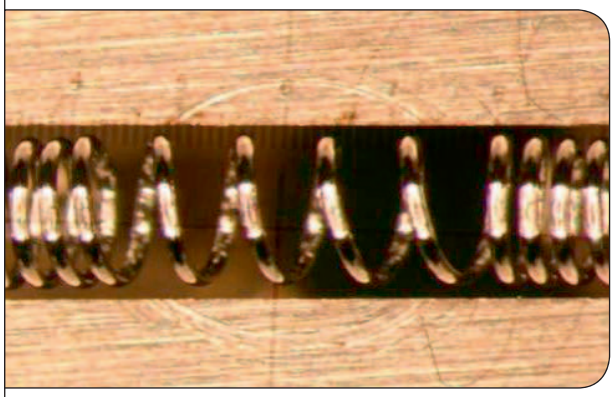
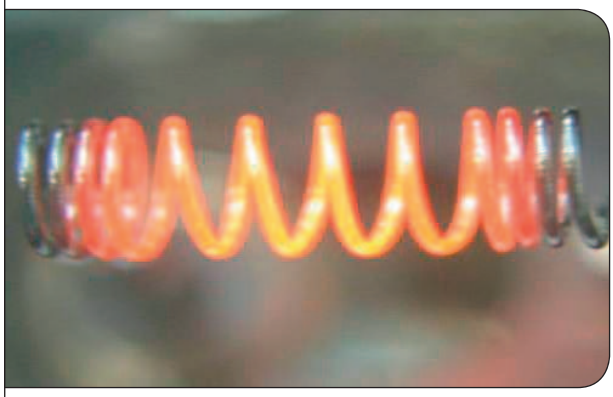
Filament



Tungsten filament - cold



Tungsten filament - hot (pre-heated)

Tungsten filament - maximum power

Physics of the filament

The electrical power of the filament in correlation to the diameter of the filament wire determinates the electronemission and the lifetime. So the current flow increases the temperature at the filament and hereby the electron emission. This effect is used to control the tube current (mA).

By **reducing the filament current** by 5% only, the lifetime will be extended by 50%.

The **Soret effect and electromigration** is based on a considerable temperature gradient longitudinally along the direction of the wire axis. The mass transport (of tungsten atoms) which occurs, produces a notched surface structure of the filament. This results inevitably in a reduced cross section which can lead to a fracture under the influence of shock or vibration or pulsed working. 50% filament lifetime reduction has to be calculated when working with a DC filament power supply.

Some applications for X-ray tubes involve mechanical **shock and vibration**. The rtw filaments are subject to special annealing procedures during the manufacturing, for high mechanical stability and high resistance to shock and vibration. Shock and vibration has to be avoided anyway.

Switching the filament on and off will cause an alternation of the filament temperature, thus creating a series of phases of internal stress, which in turn reduces the lifetime, too.

rtw recommends to preheat the filament.

During ramping up modes the filament power supply may produce **electrical overshots** (short overvoltages and overcurrent). This shortens the lifetime.

Electrical tube over power or due to insufficient cooling, ions may be released. Their electric charge being opposite to that of electrons, causes them to move opposite to the direction of the accelerated electrons and hit the filament.