The vigorous growth of the computer and telecommunication markets over the past two years has generated a considerable demand for high capacitance tantalum electrolyte capacitors. These tantalum capacitors fitted perfectly to the growing demand of high specific capacitance components for handheld applications e.g. cellular phones. They are also of great interest in the power sections of electronic data processing applications like e.g. laptops or personal digital assistants. Therefore, the growing demand for high capacitance electrolyte capacitors is expected to continue in the near future. The development of new high capacitance metal powders is considered the key step of a further increase of the capacitance of electrolyte capacitors. Niobium has always been one promising substitute of tantalum because of its adequate chemical properties and its greater availability. Within the last forty years the replacement of tantalum as anode material in electrolyte capacitors has been the goal of various researchers and companies. By means of sophisticated powder processing techniques, new capacitor grade niobium powders are available now. In the long term, niobium powders with specific capacitances of 250,000 µC/g and high specific surfaces seem to be feasible.

The aim of this contribution is to present first results of basic studies of the specific processes which go on beginning from the sintering of the new niobium powder pellets until the anodic oxidation and further thermal annealing steps. EPCOS modified its vacuum sinter process to get sintered pellets of niobium powder with high specific surfaces. A new passivation process has been developed. Meanwhile, EPCOS was the first capacitor manufacturer worldwide to launch volume production of niobium capacitors from new niobium powders in October 2001. Characterization of the conditions for the anodic oxidation of sintered niobium pellets in addition with electrochemical impedance measurements revealed that the formed niobium pentoxide behaves like a n-type semiconductor. Mott-Schottky plots were analysed. Capacitance measurements at 120 Hz and 1 kHz with applied DC bias voltages of up to 15 V show a very strong dependence of the capacitance on the applied DC bias. A decrease of the capacitance by 50 % was found (fig. 1) after the initial oxidation step. Further thermal annealing steps after the formation of the anodic oxide lead to a considerable increase of the capacitances at high DC bias voltages (fig 2). This effect is accompanied by a diminished dependence of the capacitance on the applied DC bias voltage. The determination of the oxide thickness after the anodic oxidation and further thermal annealing steps by means of scanning electron microscope (SEM) pictures showed only slight variations in the thickness of the oxide layer which cannot be responsible for the changes in the capacitance (fig. 2).