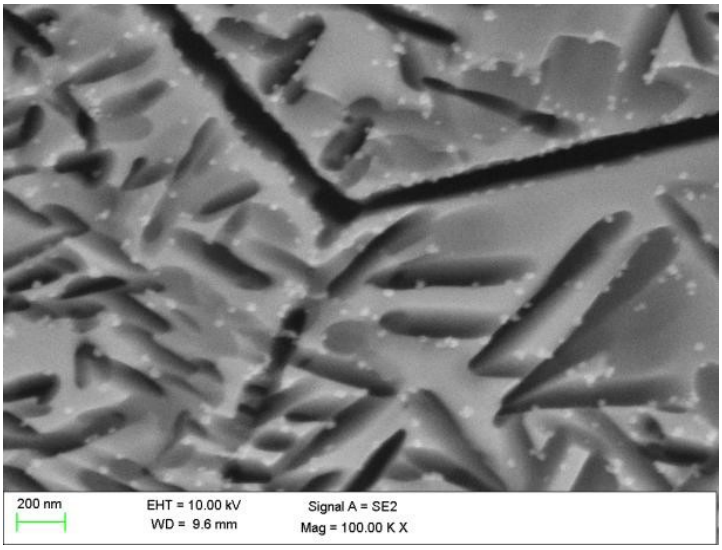
Studying the machanical properties and corrosion behavior of Ti-33Nb-2Ta-0.4O alloy for orthopedic applications

SUMMARY

Ti-33Nb-2Ta-0.4O was processed by hot rolling followed by solution treatment at 950°C and then water quenched (STQ, Solution treated and quenched). These STQ samples were subsequently aged at 400°C, 500°C and 600°C. The microstructure of these samples were characterized using X-ray diffraction (XRD) which detected only β phase in STQ and A400 whereas α+β phase in A500 and A600. Equiaxed recrystallized grains of STQ were visible in optical micrograph. The SEM micrographs of A600 confirmed the presence of α precipitates. Micro-Vickers hardness test and tensile test revealed the increase in hardness and tensile strength with aging. The corrosion rates were measured using Tafel plots which showed an increase in corrosion resistance upon aging. It was found that aging at 400°C led to maximum increase in hardness (425 HV). The sample aged at 400°C also possessed the highest corrosion resistance. Therefore, combination of high hardness and high corrosion resistance of the alloy after aging at 400°C makes it a suitable candidate for use in orthopedic applications.



SEM micrograph of A600 - Dark elongated particles are α and the white matrix is β