Experimental report

16/09/2019

Proposal: 1-03-41 **Council:** 4/2018

Title: Residual Strain and manufacture/working of Sword blades: From Sutton Hoo to the Medieval Two-Edged Swordblade.

Research area: Other...

This proposal is a new proposal

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Samples: Fe/FeC

Instrument	Requested days	Allocated days	From	To
SALSA	5	4	22/09/2018	26/09/2018

Abstract:

We intend to undertake the characterisation of 2 swords using 3-dimensional strain measurements on the Salsa engineering beam line at ILL: The axial strain from hilt to the tip, the transverse strain from edge to edge and the normal strain from face to face. The same characterisation will be performed for 3 the archaeo-reconstructed blade parts representing the Sutton Hoo blade type and the laminar Medieval blade. We request 5 days beam time on Salsa.

Report 1-03-41: Residual strain and manufacture/working of Sword blades: From Sutton Hoo to the Medieval Two-Edged Sword blade.

Background: In collaboration project with the Deutsches Klingen-Museum - Solingen (Dr S. Wetzler), the Royal Armouries - Leeds (Mr H. Yallop), LVR LandesMuseum Bonn (Mr H. Becker and Dr E. Nieveler) and the archaeo-blacksmith Mr H.Cole MBE, a pilot study is in progress to study the material properties and working on the Medieval Sword covering the period from the 6^{th} – 14^{th} Century.

In the 3 days allocated beam time for experiment 1-03-41 we have been able to study the xyz strain at 3 position on a 10^{th} Century sword blade with a missing letter inlay of the Ulfberth sword. See Fig.1.

We measured the x, y, z strain through the middle of the blade from edge to edge with a diffraction volume of 1 x 1 x 1 at 34, 25, 14 cm measured from the tip of the sword blade. The d_0 value was determine from the stress balance of the transverse stress component across the thickness of the blade using the data at 25 cm position.

We obtained in general a trend xyz strain values varying from 500 με to -500 με and related to the xyz stress values varying from 100 MPa to -100 MPa from the edge of the blade to the middle of the blade to the opposite edge. We observe a cancelled-out strain-stress at the positions ¼ and ¾ along the blade length. These positions correspond to extremes of the fuller width. This may indicate that the edges are welded on. The van Mises stresses were also calculated see fig.1, bottom. Detailed differences are found at positions 14 and 35 cm.

The results will be related to data neutron tomography data from V7: HZB- Berlin and ND from INES (RAL). A paper is presently being prepared.

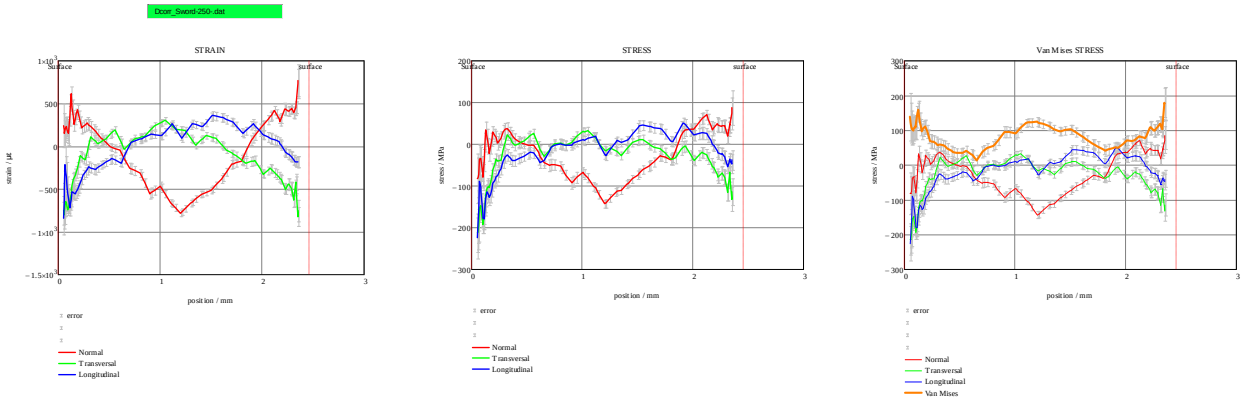

Fig.1. Left: Ulfberth sword and scan positions. Bottom: xyz strain, -stress and - van Mises stress at position 25 cm.