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North Rn Lab
Rusley

R/D 5876-MS-01

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Progress report No.3: 29 March 1988 - 29 September 1988

Contract: DAJA45-87-C-0044

Contract Value for above period: \$4,000

Contract title: Advanced Tribological Coatings for High Specific Strength Alloys

1. A presentation on the progress of this contract was made on the 12 April 1988 at the SCORE meeting held at the Ministry of Defence, London.
2. A review of the contract progress, was made at NCT by members of the SDIO Tribomaterials Technology Insertion Working Group. Dr K Gabriel of the US Army Materials Technology Laboratory, Watertown was present.
3. A presentation on the progress of the contract was made at NCT, on 28 July 1988, to Dr W Simmons, European Research Office and Dr T Hynes, US Army Materials Technology Laboratory, Watertown. A summary of the contact status was provided.

4. Specimen/surface treatment status

4.1 CYD coatings of boron, aluminium and chromium nitride

Coater: Diffusion Alloys, UK.

Claimed to be able to deposit at temperatures below 900 °C, thereby avoiding distortion and massive grain growth.

Status: Company only able, in practice, to deposit aluminium at below 900 °C. Plate specimens treated and metallographic sections prepared. A 25 micron depth of aluminised layer has been formed, of hardness 360 HV 50g. But the high temperature treatment has caused softening of the substrate (from 380 HV to 280 HV 20kg). This is a promising result and further plate samples have sent for treatment at differing conditions to ascertain if the hardened layer (of titanium aluminides) can be formed without substrate tempering or whether re-resolution treatment will restore substrate properties (JS)

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4.2 Plasma boronising

Potential Coater: Birmingham University, UK

Status: Discussions are continuing with Birmingham University for the application of this process.

4.3 Ion implantation

Coater: Tech-Ni-Plant, UK.

Because of shallow depth, unlikely to confer demonstrable wear benefits, unless under very low stress applications. For reference purposes plate specimens have been nitrogen implanted.

Status: Plate specimens returned and metallographic section prepared. No observable surface layer or change in microhardness (50g load).

4.4 Salt bath treatments for nitriding, nitrocarburising & nitrocarburising/oxide growth

Coaters: British Metal Treatments, Poetons

Status: Nitrocarburising (Noskuff) & nitriding (Tufftride) have no observable effect on plate specimens. With revised conditions, nitrocarburising/oxide growth process (Nitrox P) had vigorous action on plate specimens; these have been returned and metallographic sections are currently being prepared.

4.5 Gaseous beta nitrocarburising

Coater: Huytons, UK

Status: Plate specimens returned and metallographic sections prepared. After 16hr treatment (at 300 °C), no observable surface layer or change in microhardness.

4.6. Plasma nitriding

Coaters: Birmingham University, JJ Castings and Blandborough-Nemo, Asset.

Status: Blandborough-Nemo no longer offer plasma nitriding as a commercial service. Discussions are continuing with Birmingham University; it is known that significant progress is being made

by BU in plasma nitriding of Ti alloys, under European funding. Plate specimens from JJ Castings received; these show shallow layer of surface hardening (1 micron). JJ Castings have made contact with a German company (DeGussa) which claims to be able to plasma nitride Ti alloys to greater depths. In light of information received, processing preparation and conditions have been revised by JJ Castings. New plate specimens are currently undergoing coating.

4.7 Anodising (hard)

Coaters: Poetons, Acorn Hardas

Status: plate specimens returned from Acorn Hardas, coating depth less than 1 micron, no observable change in microhardness. Revised conditions being tested since commercial process (Tiffan), although no longer available, could produce anodised layers on Ti alloys typically 5 to 10 micron in depth. Specimens treated by Poetons show similar results to those of Acorn Hardas. Poetons claim Tuffram to be effective on Ti alloys (anodised + codeposition of PTFE). Plate samples sent for treatment.

4.8 Bath carburising + vanadium carbide growth

Coater: British Heat Treatments (known as Toyota Diffusion process)

Status: plate samples reported to be 'satisfactorily' coated. Specimens returned, however metallographic specimens show no evidence of surface reaction or hardened layer.

4.9 High temperature ion-plating of aluminium

Coater: NCT. Object is to form $TiAl_3$ precipitates in surface by diffusion.

Status: specimens not yet treated.



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