Efficacy of coatings and thermochemical treatments to improve wear resistance of axial piston pumps

G. Schuhler, A. Jourani, S. Bouvier, J.-M. Perrochat

PII: S0301-679X(18)30235-4

DOI: 10.1016/j.triboint.2018.05.007

Reference: JTRI 5220

To appear in: *Tribology International*

Received Date: 15 October 2017

Revised Date: 31 March 2018

Accepted Date: 4 May 2018

Please cite this article as: Schuhler G, Jourani A, Bouvier S, Perrochat J-M, Efficacy of coatings and thermochemical treatments to improve wear resistance of axial piston pumps, *Tribology International* (2018), doi: 10.1016/j.triboint.2018.05.007.

Efficacy of coatings and thermochemical treatments to improve wear resistance of axial piston pumps

G. Schuhler [a,b,@], A. Jourani [a], S. Bouvier [a], J-M. Perrochat [b]

[a] Sorbonne Université, Université de technologie de Compiègne, FRE UTC-CNRS 2012 Roberval, Centre de recherche Royallieu - CS 60 319 - 60 203 Compiègne cedex, France
[b] Interiors, Actuation & Propeller Systems, UTC AEROSPACE SYSTEMS, 43 Rue des Prés, 27950 Saint-Marcel, France

E-mail: guillaume.schuhler@utc.fr

Abstract

A former study on wear in helicopter axial piston pumps showed the main wear mechanism in the contacts slipper/swashplate is abrasion due to carbides removal. Resulting debris and particles pollute the lubricating fluid leading to abrasive wear in most contacts. Accordingly, surface treatments on the swashplate steel are proposed to reduce slipper/swashplate wear. This study consists in a multitechnical experimental analysis of these solutions in dry and lubricated conditions. With lubricant, steel without treatment suffers carbide removal. PTFE coating prevents it by diminishing the coefficient of friction but are less resistant in highly loaded contact. Nitriding results in higher wear resistance, especially when lubricated. (DLC+WC) coating is the most efficient in dry conditions by minimizing friction coefficient and wear rate.

Keywords: Stainless steel; coating; wear mechanisms; axial piston pump.

1) Introduction

Axial piston pumps convert a motor rotation into hydraulic power (figure 1). The motor rotation is transmitted to the barrel which drives piston-shoe assemblies, the ball-joint and the shoe-hold-down-plate (SHDP). A spring pushes the ball-joint on the SHDP which holds the shoes against the swashplate. As the shoes slide on the swashplate, its tilt forces pistons to translate in the cylinder bore and to pump fluid. The valve plate then distributes the fluid in the hydraulic circuitry. Hydraulic fluid fills the pump housing and acts as a lubricant. Piston/shoe and shoes/swashplate contacts benefit a better lubrication due to a hole in the pistons and shoes that lets a small amount of pressurized fluid out of the barrel.

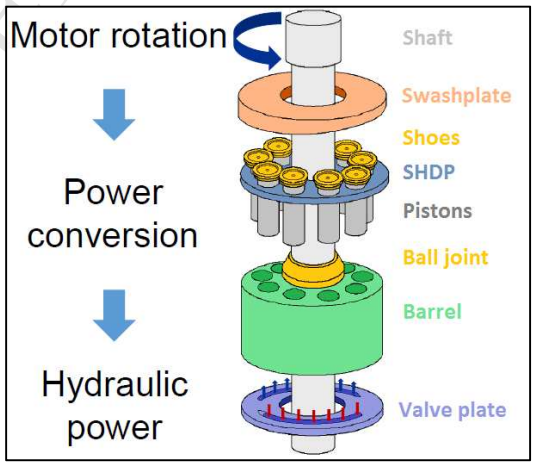

Figure 1: Axial piston pump exploded view