INTERNATIONAL SOCIETY OF
BIONIC ENGINEERING

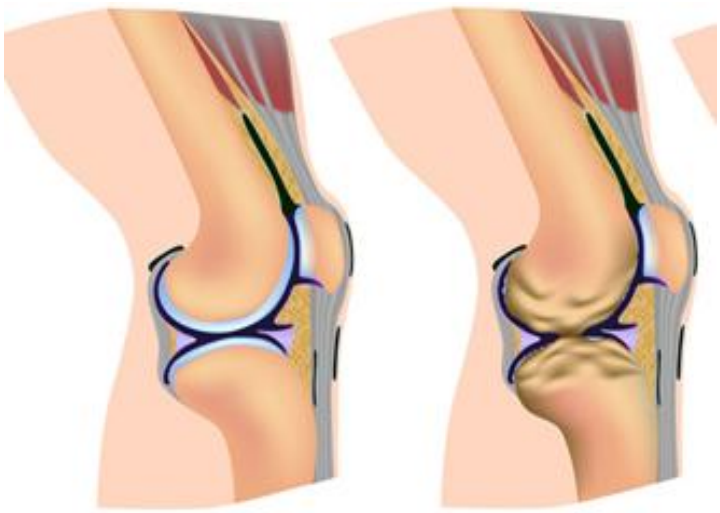
Bionic lubrication, reduce friction between rod and packing

From the knee joint to the bionic sealing device

The case was provided by the Individual Member of ISBE (FM095): Research Institute of Petroleum Exploration & Development, China

1. Biological Prototype

Sodium hyaluronate is the main component of synovial fluid and lubricates the joint cavity, when lack of synovia, it causes joint wear, arthritis and pain, inject lubricant like sodium hyaluronate can solve the problem.



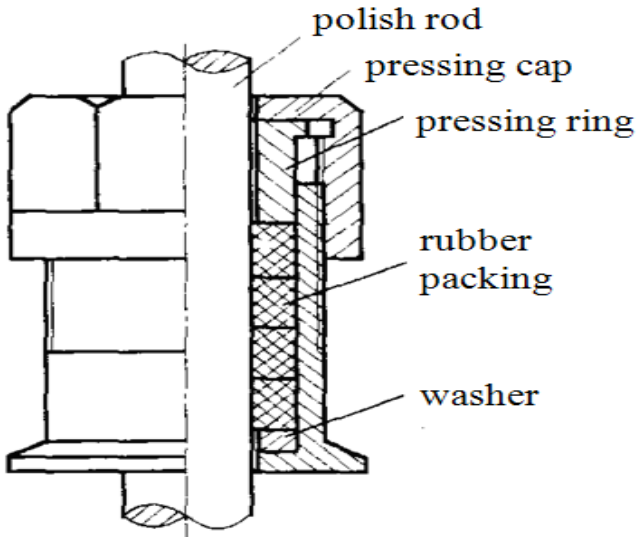
Inject lubricant like sodium hyaluronate

Inspired by the knee joint, a wellhead sealing device has been designed and applied in oilfield.

2. Design and Processing

Bionic lubrication, reduce friction between rod and packing

- In China, there are +100 thousand pumping wells, which accounts for 85% of the wells in the whole country.
  - Day power consumption of single well is about 300~550kW.h
  - System efficiency of single well is only 15~25%

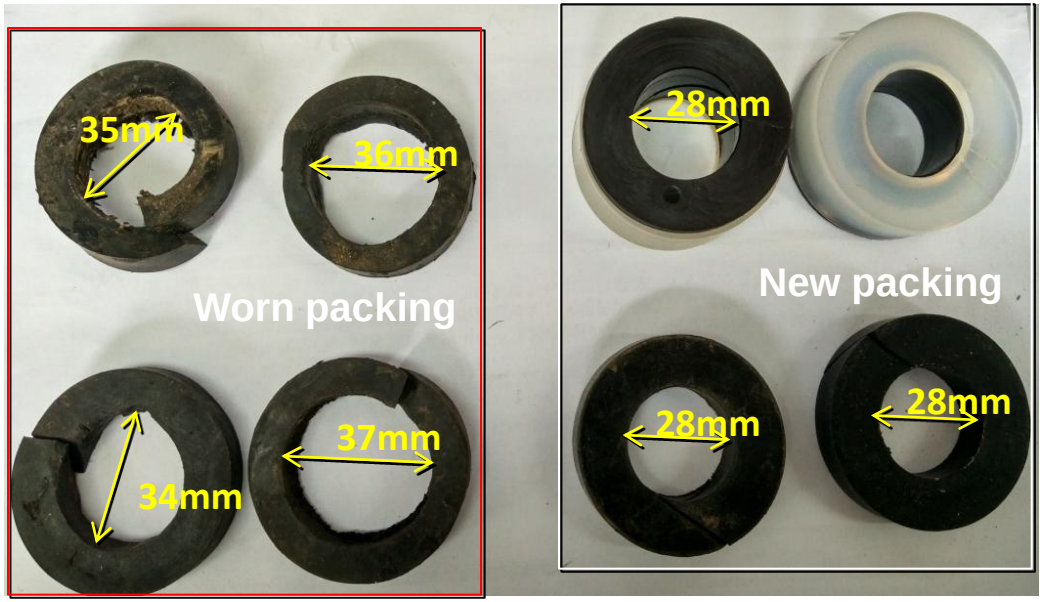


Schematic of rod/packing sealing

2. Design and Processing

- **Rod (steel) / packing (rubber) dry friction causes:**
  - **High friction, high power consumption**
  - **Packing wear, sealing failure**
  - **packing replacement cycle is 30~60 days**
  - **Oil/water leakage, environmental pollution**

Water and oil leakage



2. Design and Processing

Bionic rod/packing sealing device

- Preloaded spring provides proper force
- an oil storage chamber, oil pre-saturated super-oleophilic porous material
- during the operation, keeps the rod and packing lubricated

3. Achievements and Application

- Field trail 131 wells in Daqing oilfield.
- Power saving per well is 5~17 kW.h per day.
- Packing replacement cycle increases from 30~60 days to 130~200 days.
- No water/oil leakage .

Small device, playing a big role