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INVESTIGATION ON THE WEAR OF WELL-TUBING IN THE OIL EXPLOITATION

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ABSTRACT

In this paper, the results of investigation of wear of well-tubing with the sea depth from 3000 to 5000 meters are presented. The theory of erosion for tubing is established basing on the flow of exploited products and the principles of erosion and corrosion, for calculating the wear of thickness of tubing and the influence of environment and exploited oil products flow (pressure, velocity, temperature etc.). The long-life of tubing is determined for the maintenance service. Various proposals for increasing effectiveness of tubing exploitation are presented as materials changing, manufacturing, improving etc.

Key words: Well-tubing, Wear, Oil product, Sea

1. INTRODUCTION.

Well-tubing is the first mechanism receiving and transporting exploited oil products from the depth until 5000m of Vietnam oil offshore the needs of well-tubing for only one mine with 200 holds are about 250 tons per year. But the economic lost by the degradation failures of the well – tubing is many time greater.

Investigation on the wear of well-tubing in the oil exploitation and determination of the method for increasing the exploitation effect of well-tubing are necessary. In this paper, the authors present the mechanism and the calculation method of the wear-erosion for well-tubing surfaces, connecting the flow of oil products. The results of experimental study including the influence of pressure, temperature, depth, flow, tubing structure are presented.

2. THEORETICAL INVESTIGATION.

The main kind of wear of well-tubing is erosion of surfaces destruction process depending on the high speed flow of liquid and gas of oil exploited products, the properties of well-tubing materials, the running conditions (load, temperature, etc…).

Erosion of materials is a process of surface destruction under the interaction of external environment. In the case of the wear of well-tubing in the oil exploitation erosion is the surface destruction of material under the mechanical interaction of high-speed flow of liquid, gas, steam or the mix of liquid, gas, abrasive particles. For the erosion of well-tubing in the oil exploitation there are different kinds of gas erosion, cavitation by contact with gas-liquid flow and abrasive erosion. Every kind of erosive consists of small groups as abrasive erosion, liquid-gas abrasive erosion etc... In this paper the kind of erosion is determined for well-tubing.

After KRAGELSKI I. V. and William A. [1] the theory of erosion was investigated since sixty years of 20th century about the cavitation of particles, the cutting phenomena on the wear surface and the dynamic cavitation under the condition of plane wear surface.

The mechanism of erosion is the mechanism of wear process, insolating abrasive particles from the surface under the interaction of liquid, gas or mix flow. In the processus of erosion there are no only one kind but also various kinds of mechanism of wear, depending on the combination of running conditions, materials and environment. In this paper we will have the analysis for the surface erosion under the contact with multiphase mix flow. The different factors as flow velocity, attack angle, surface material and their influence will be investigated.

The investigation of the multiphase flow through the well-tubing is complicated and very important for determining the erosion.

According to the theory of Kragelsky I.V. and William A., the wear of the thickness of well-tubing is the function of speed of the flow of exploited oil products, the depth of exploitation, pressure, temperature, running time and other various parameters of force interaction (turbing weight, stress, hydrodynamic force etc...).

$$\Delta S = \sum_{m=0}^{m} A_m Q_{cl}^m + \sum_{n=0}^{n} B_n Q_{kh}^n + \sum_{p=0}^{p} C_p Q_d^p + D(P_m) + E(T_m) + F(t_{lv}) + bH + a,$$

Where

Qcl, Qkh, Qd – flow of exploited oil products in the form of liquids, of gas and of oil;

D(Pm), E(Tm), F(tlv) – relationship of the influence of Pm, Tm, tlv on ΔS;

Pm, Tm, tlv pressure, temperature and running time of flow, which relationships with the wear of thickness ΔS can be assumed to be linear;

A0, A1,..Am ; B0, B1,…, Bm; C0, C1,…, Cm, a, b, m, n, p and relationship D(P), ETM, F(tlv) are depending on influencing parameters and are determined experimentally.

3. EXPERIMENTAL INVESTIGATION.

The surfaces, the thickness of the exploited well-tubing are measured for determining the thickness, the form and the

distribution of the surface failures.
Thickness is measured by ultrasonic application TT-100, 26DL-Plus, 36-DL plus digispect, electromagnetic Grammar-Ray, Epcho III. The measured data are presented in Figures 1-6.

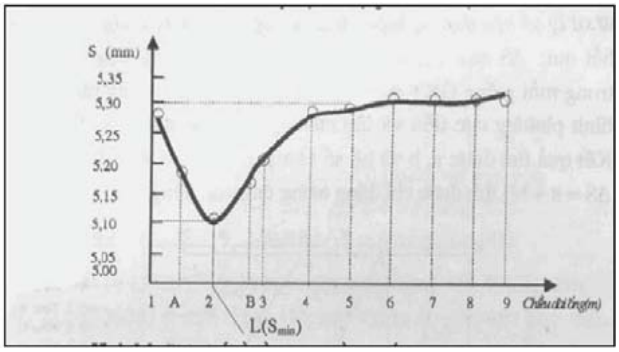

Fig.1. Distribution of thickness depending the length of well-tubing S=f(L)

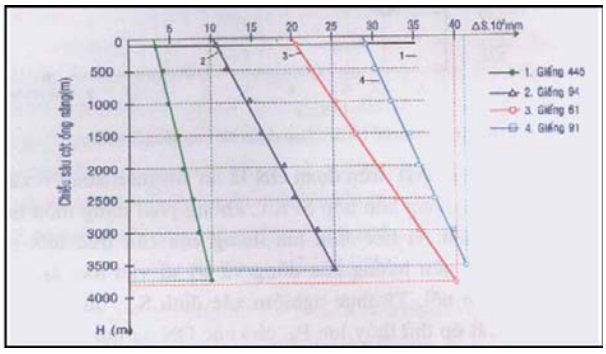

Fig. 2. Relationship between wear of thickness and depth of well-tubing

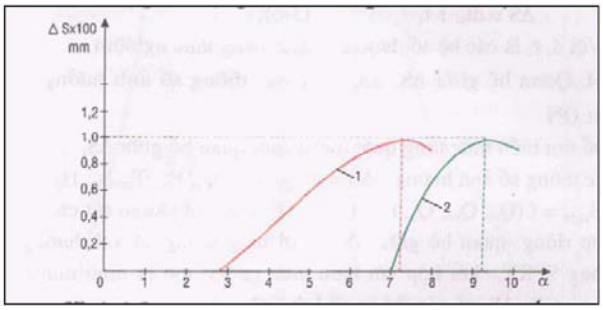

Fig.3. Relationship between wear of thickness and well-tubing curve angle

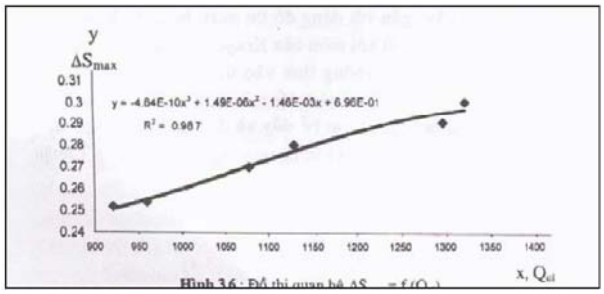

Fig.4. Relationship between ΔS an the flow of liquid

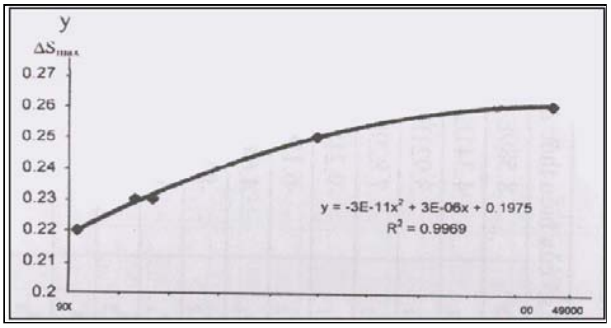

Fig.5. Relationship between ΔS an the flow of gas

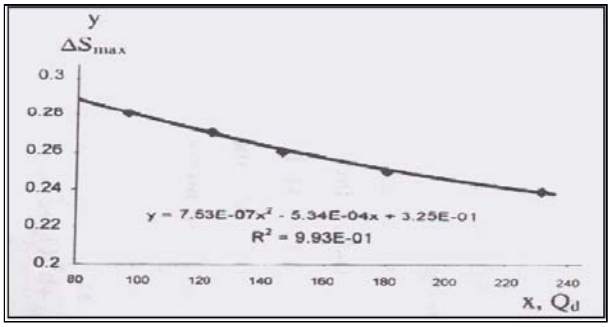

Fig.6. Relationship between ΔS an the flow of oil

4. CONCLUSIONS

1. The main kind of wear for well-tubing is erosion by the contact with the flow of exploited liquid-gas-oil products

2. The relationship between the wear-erosion and the influencing factors as tubing material and form, temperature, depth, flow etc. is presented.

3. The calculation of the long-life of well-tubing, basing on the authorized limit of thickness, is very necessary for the security and the capacity of oil exploitation.

5. REFERENCES.

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