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Modeling Control in Thread Process of Screw

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Abstract: *- The screw producing is an important process course. The certain defect is found so this process will be paid attention. In this paper modeling of process is analyzed. With increasing time the force decreases. With decreasing threading length from 350mm to 220mm the force increases from 30N to 50N at the time of 0.2s. It is found that with increasing diameter from 3mm to 4.5mm the force decreases from 55N to 22N at the same timed. With increasing mass from 2.16g to 2.8g the force decreases from 35N to 27N too. Meantime when the time is beyond 0.5s the curves have convergence to one little value of zero from all of figure curves. It explains that when the thread time is shorter than 0.5s the mold can wield big force to thread. If the time is over this value the little force will need to thread process. Do this paper to cause technological engineer's attention and advice. In general if diameter of screw is high force may decrease. The force is low if mass of screw becomes low. Finally if length becomes low the force may increase. The effective turn to force which affects work hardening is L>d>m in thread process. As to mould and screw produce the regulation shall be proceeded completely. Not only mould but also materials size & mass do we check and consider off in this process.*

Keywords: *- modeling analysis；screw；thread; mold; mass; diameter; length*

1. Introduction

Almost every screw will be processed thread in screw manufacture. The uneven thread can form crack & burr and crack; small & big size diameter; small torque etc. off specification etc. The crack is primarily unqualified because of the work hardening primarily in surface. This affects seriously qualification so that reproduction and the scrapping happens. [1~2] As to the crack the cause to be clarified carefully and a certain machine regulation is needed. Staffs with responsibility regulate in order to resolve this technical issues and increase qualified products amount ratio. [1] When screws are assembled in a certain preload. After some time the crack will happen. In general there are two situations of screws to be broken: One is if torque is oversize and the other is the torque is smaller than regulation. Before forge process is proceeded in order to decrease the material Diameter which cause work hardening to decrease good properties. Meantime because of some force role the structure forms work hardening so becomes big crystal grain. This make negatively effects to later thread. So manufacture and technique division should pay attention to this. To reduce small change is land theory. With improving workers' major capability we make the good tactics crystal grain solved in time. In this paper the relationship between force and power & time and too mold length and diameter & mass is established and discussed to check work hardening phenomena. Three factors are investigated with effective role to force in turn. Maybe it shall afford designer and technique staff good result for them to design and regulate machine to produce excellent screws. Because work hardening is relation to design parameter. It should be economical and convenient way to refer to below turn. So that in design

department the engineer need to consider these whole to ensure the production to attain saving energy meanwhile promote its capacity of work. So we proceed below numerical computation to establish thread modeling in a course so as to promote capacity and save material and machine. For the sake of cost control it is good to use small materials under condition of wanted capacity meanwhile it can do big size screw to decrease force and length of mold, which is the aim of this paper.

2 Calculate Courses

2.1 Thread dynamics& kinematics

It is schematics of thread process mould as shown in Figure 1. L is mould length and thread line is marked here.

According to energy conservation law according to Figure 1 [2]

$F = Q / l$ ----- (1)

So obtain equation

$F = \frac{mv^2}{2l}$ -------- (2)

From kinematics it has $v = \pi dn$ ------ (3)

Take equation (3) place of equation (2)

So gain equation $F = \frac{m(\pi dn)^2}{2l}$ ----- (4)

And from kinematics it has $l = vt$ ------- (5)

Here v mm/s is velocity of screw rotation; n r/min is rotation; P Kw is power； F is the force by thread. From Table 1 t is the thread time in the whole length, m is mass; d mm is the screw external diameter.

The parameters of screw thread processes is listed in Table 1.

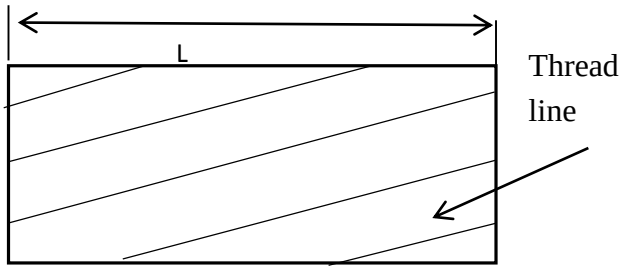


Figure 1 the mold sketch for threading screws.

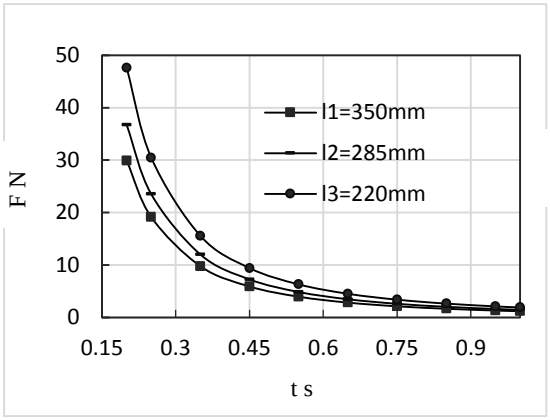
Table 1 the parameters of the threading screw process.

parameters	d, mm	1,mm	t,s	m, g	materials
Value	3, 3.6, 4.5	220, 285, 350	1	2.16, 2.5, 2.8	low C steel

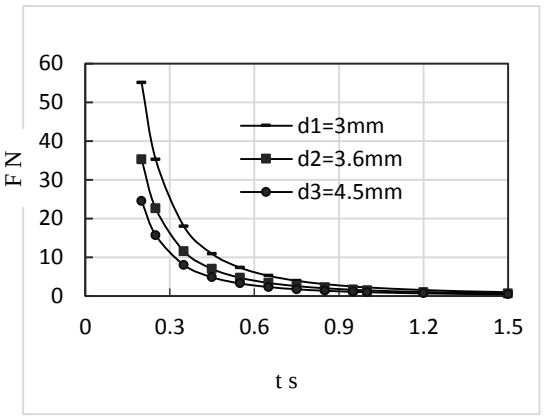
3 Discussion & analysis

From the Figure 2 (a) with increasing time the force decreases. With decreasing threading length from 350mm to 220mm the force increases from 30N to 50N at the time of 0.2s. As shown in Figure 2(b) with increasing diameter from 3mm to 4.5mm the force decreases from 55N to 22N at the same time. From Figure 2(c) with increasing mass from 2.16g to 2.8g the force decreases from 35N to 27N too. Meantime when the time is beyond 0.5s the curves have convergence to one little value of zero from all of figure curves. It explains that when the thread time is shorter than 0.5s the mold can wield big force to thread. If the time is over 0.5s the little force will form to process. In general, if diameter of screw is high force may decrease. The force is low if mass of screw becomes low. Finally if length becomes low the force may increase. The effective turn to force which affects work hardening is L>d>m in thread process. As to mould and screw produce the regulation shall be proceeded completely. Not only mould but also materials size & mass do we check and consider off in this process. For instance for saving material of mould

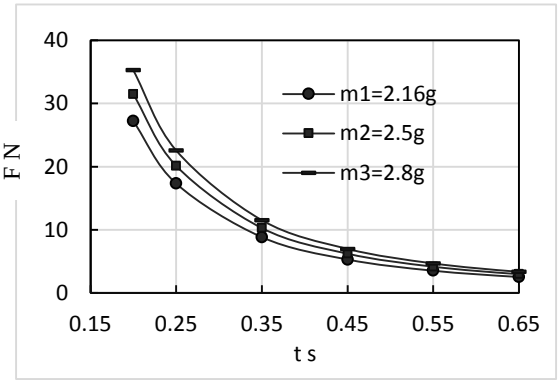
we could decrease the length to ensure force increasing for capacity and velocity decreasing for save. As for diameter in order to increase force it can be used small diameter. The third, for decreasing force it is adopted small mass product for economy.



(a) l_1,l_2 &l_3

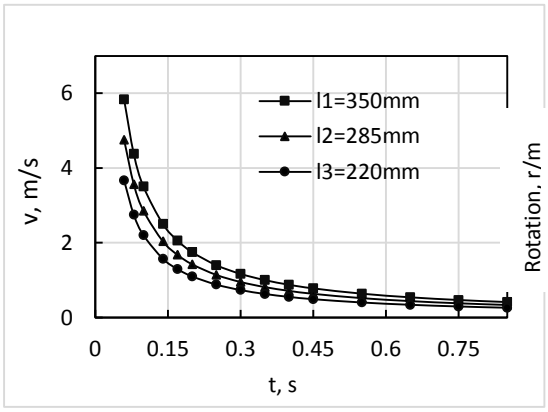


(b) d_1,d_2&d_3

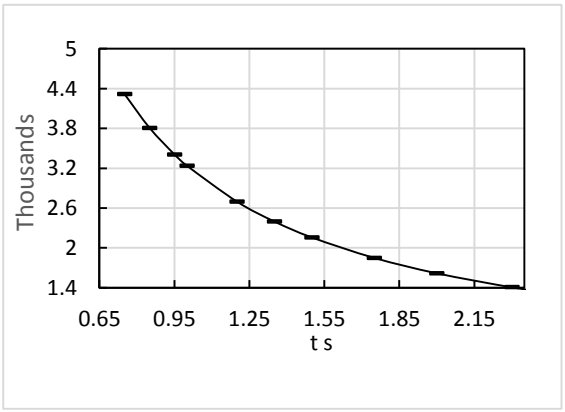


(c) m_1,m_2 &m_3

Figure 2 Relations between force and times in screw manufacturing with different screw parameters of l, d & m.

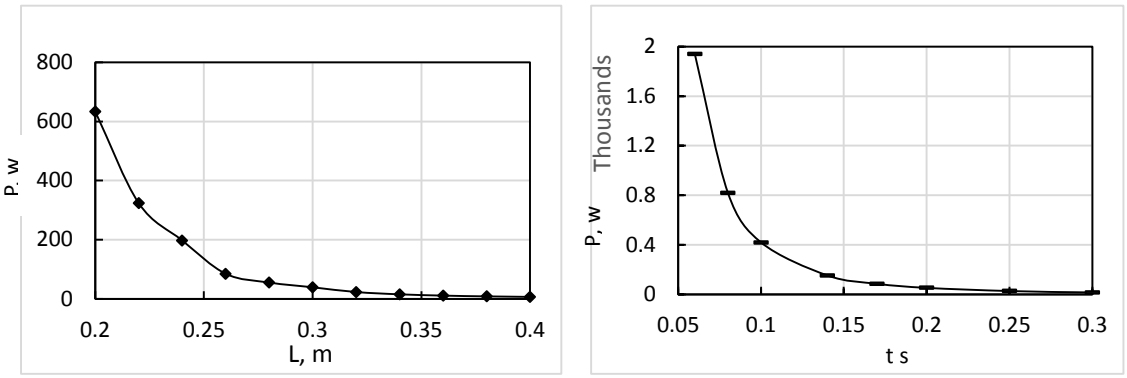


(a) v



(b) n

Figure 3 Relations between velocity, rotation & power and times in screw thread.



(a) l (b) t

Figure 4 Relations between length and time & power in screw thread.

(a) m=1.9g; d=2mm; l=350mm; (b) d=2mm; l=350mm

From Figure 3(a) the relationship between velocity and time is observed. The velocity decreases with the increasing time and meantime the velocity decreases with the length decreasing. The velocity may decrease sluggishly after 0.2s. When mould length is low the velocity is low too. It expresses that saved energy and length is high with the decreasing mould length though the force becomes high. In Figure 3 (b) it is observed that rotation decreases with the increasing time in the course of thread. The rotational speed decreases from 17,000 r/m to 8,000r/m in the time of 0.15 to 0.45s. The less rotation is the more the time is. For saving mould length the high rotation needs. From Figure 4(a) it is known that the power may decreases with the increasing length of mould. At the length of 0.25m the power decreases to 180W then becomes sluggish untill length of 0.35mm. From Figure 4(b) is known that power decreases too with the course time. The latter curve decreases steep first then it reduces sluggish at time point of 0.15s as well. It explains that the rotational speed reducing leads to low power here. Power rate is higher than rotation decreasing time. After it attains 0.2s below the 50W maintains from 400W firstly. The uneven circle in axis produces from forge to produce matter in threads. So the next thread process is to ensure the process to even.

The education to staffs is proceeded responsibly in order to materials technique state. The criticism is also to those lazy ones for no ensuring production design technique such as diameter and other demand. Staffs education need to pay attention to some random design to make unqualified in shops. They raise their knowledge of metal thread structure and prohibit failure of crack even head broken etc. The education want to be trained by special members so that through it workers or technique staffs may raise special capability of reasonable design on the original forming course. So the trainer need to provide special and necessary know-how and knowledge in order to promote technique staff designing and worker's making levels.

The module company needs to adopt good quality rolling mould for us to thread good. This should be proposed to conference to discussion and adopt fit mould materials and treatment to ensure the perfect tool to us. As to the unqualified mould the returning and fixing method to adopt. Mould is the most important component we need to increase our knowledge for technological capability and guarantee its use life. Once the distance between two moulds is too far the dummy will happen. It may affect seriously the assembly to become hard or over force.

3 Conclusions

1. Overviews, the work hardening is the main reason of head failure. The effective turn to force is L>d>m in thread process. As to mould and screw produce the regulation shall be proceeded completely. With increasing diameter from 3mm to 4.5mm the force decreases from 55N to 22N attained 2.5 times in screw thread. It is to promote technology and technique level. For saving material of mould we could decrease the length to ensure force increasing for capacity and velocity decreasing for save. As for diameter in order to increase force it can be used small diameter. The third, for decreasing force it is adopted small mass product for economy.
2. As to engineer we need to contract in order to manage strictly and technological sharply which is a good tactic. The technological engineer will reform devices and correctly regulating thread machine to ensure qualified precisely. It is insisted that we is not to manage leisurely. To reduce the negative effects and increase knowledge of technique and improve the train. Only if the unqualified of crack is denied we can promote corporation technique level.

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