**密封间隙对极齿结构参数选择的影响研究**

**Study on the influence of seal gap on the structure parameter selection of pole tooth**

因*Lp*较大时对齿高会有较大要求，选用*Lp=19.2mm*模型研究*Lg*对*Lh*选择的影响。*Lp=19.2mm*不同间隙下各极齿结构参数密封装置耐压能力如图17所示，结合图9-*a*，发现随着*Lg*增大，密封装置耐压能力迅速下降。这是因为随着*Lg*增大，密封间隙漏磁增多，单个极齿所能形成的*ΔB*减小，所以*ΔBz*随之减小。

When the seal size *Lp* is large, the tooth height *Lh* should also be large. So the model, *Lp=19.2mm*, was used to study the influence of the seal gap *Lg* on the tooth height *Lh* selection. Fig.17 shows the sealing capability of the sealing device with each structure parameter of pole tooth at different seal gap *Lg* in *Lp=19.2mm*. Combined with FIG. 9-a, it can be found that the sealing capability of the sealing device decreases rapidly with the increase of the seal gap *Lg*. The seal gap flux leakage increases with the increase of the seal gap *Lg*, and then the *ΔB* that can be formed by each pole tooth decreases, so the *ΔBz* decreases accordingly.

研究各*Lt*、*Ls*下的齿高阈值，如图18所示，结合图11-*a*分析。由于随着*Lg*增大，密封装置耐压能力迅速下降，耐压能力的基数减小，使得*ΔBz*较易在2%左右波动而出现更多的波动点。

The tooth height threshold was studied with each tooth width *Lt* and groove width *Ls*, as shown in Fig.18, and analyzed in combination with Fig.11-*a*. With the seal gap *Lg* increases, the sealing capability of the sealing device decreases rapidly. When the sealing capability is small, the *ΔBz* tends to fluctuate around 2% to cause more fluctuation points.

为便于分析，结合原始数据，对数据进行修正。

In order to facilitate the analysis, partial fluctuation points were ignored in combination with the original data.

根据图19，分析不同*Lg*下*Lt*与*Ls*较大时稳定的的关系，

According to Fig.19, the stable tooth height threshold when the tooth width *Lt* and the groove width *Ls* are large enough under different seal gap *Lg* was analyzed.

对于*Lg=0.2mm*，基本符合；对于*Lg=0.3mm*，基本符合。

For *Lg=0.2mm*,the tooth height threshold basically conforms to; for *Lg=0.3mm*,the tooth height threshold basically conforms to .

结合图12，发现总体基本符合，在本研究范围内为线性关系。

Combined with Fig.12, the tooth height threshold basically conforms to .

根据图20，研究不同*Lg*下*Ls*与的关系。

According to Fig.20,the tooth height threshold under different tooth width and groove width was analyzed.

对于*Lg=0.2mm*，符合；对于*Lg=0.3mm*，符合。

For *Lg=0.2mm*,the tooth height threshold basically conforms to; for *Lg=0.3mm*,the tooth height threshold basically conforms to .

结合图13，在本研究范围内均符合负指数关系，且发现系数均随*Lg*的增大而增大。若只考虑最大值，可看出，当*Lg*从0.1*mm*增长到0.2*mm*时，最大值增加了0.26*mm*，但是当*Lg*从0.2*mm*增长到0.3*mm*时，最大值仅增加了0.06*mm*，有放缓的趋势。

Combined with Fig.12，the tooth height threshold() and the groove width(*LS*) meet the negative exponential relation properly. The intercept coefficient in the function increases with the increase of the seal gap. When the seal gap *Lg* increases from *0.1mm* to *0.2mm*, the intercept coefficient increased by *0.26mm*. However, when the seal gap *Lg* increases from *0.2mm* to *0.3mm*, the intercept coefficient increased by only *0.06mm*, which has a tendency to slow down.

进一步研究齿宽与槽宽的影响。对于*Lg=0.2mm*和*Lg=0.3mm*，当*Lh=1.0mm*时均可认为耐压能力不随*Lh*增加而增加，同时为了保持与前面研究的一致，选取*Lh=1.0mm*的数据进行分析，如图21。其中，根据前面所总结的规律，为*Lg=0.3mm*，*Lp=9.2mm*的模型，增加*Lt=0.6mm*的仿真实验，如图21-*f*所示。

The influences of tooth width and groove width on sealing capability of sealing device are studied. The sealing capability of the sealing devices with the seal gap *Lg* of *0.2mm* or *0.3mm* are considered no longer to increase with the tooth height when the tooth height greater than *1mm*. And to be consistent with the previous studies in this paper, the sealing capabilities of the model with tooth height of *1mm* are analyzed, as shown in Fig.21. According to the rule summarized above, it is necessary to add the simulation experiment with tooth height of *0.6mm* for the model with seal gap of *0.3mm* and seal size of *9.2mm*, as shown in Fig.21-*f*.

结合图15与图21，研究不同极靴长度、密封间隙大小下最佳耐压能力的极齿结构参数，如表4。

Fig.15 and Fig.21 are combined to study the structural parameters of the optimum sealing capability model with different seal size and seal gap, as shown in Tab.4.

研究发现，齿宽的选取与极靴长度和密封间隙大小相关，当*Lp=9.2mm*时，应选择*Lt=2Lg*。这一结果与文献[5]中一致，然而但当极靴长度增加，其关系式发生变化：当*Lp=19.2mm*时，应选择*Lt=Lg*；当*Lp=14.2mm*时，应选择*Lt=0.1+Lg*。从中可以看出，最佳齿宽的取值不只与密封间隙相关，还与极靴长度相关。

Observing the relationship between the tooth width *Lt* and the seal gap *Lg*, for *Lp=9.2mm*, the tooth width is twice the size of the seal gap, *Lt=2Lg*. This is the same as the result of reference 5. However, for *Lp=19.2mm*, the tooth width is equal to the size of the seal gap, *Lt=Lg*; for *Lp=14.2mm*, the tooth width is equal to the size of the seal gap plus 1*mm*, *Lt=0.1+Lg*. It is found that the optimum tooth width is not only related to the seal gap, but also to the seal size.

结合不同极靴长度、密封间隙大小下最佳耐压能力的槽宽选择进行分析，可知，槽宽的选择主要与密封间隙相关，总体看，选取*Ls=4Lg*时密封装置拥有最佳的耐压能力。由于齿数必须是整数，根据齿数计算公式，某些齿宽、槽宽对应的实际极靴长度更接近或等于规定的最大极靴长度，也就是更充分的利用了密封尺寸。所以表中最佳耐压能力对应的槽宽稍偏离于*Ls=4Lg*。

The optimal groove width *Ls* is mainly related to the seal gap *Lg*. When the sealing device has the best sealing capability, the groove width *Ls* is basically 4 times the size of the seal gap *Lg*, *Ls=4Lg*. According to the calculation function of the number of teeth, the length of the pole is closer to or equal to the seal size *Lp* in some groove width, because of the number of teeth must be an integer. In other words, the seal size *Lp* is more fully utilized. Therefore, the groove width *Ls* of the optimum sealing capability model is slightly deviated from the value calculated by the function.