

THRUST AND THRUST-TO-POWER RATIO IN ELECTROHYDRODYNAMIC PROPULSION ELECTRODE SYSTEMS

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Abstract: Dependences for the efficiency of ionocraft electrode system and the magnitude of the thrust were obtained for different polarity of the corona. The most effective mode of work lifters of the considered structures is achieved at low current. The increase of distance between the corona electrode and the collector gives the growth of thrust and thrust-to-power ratio up to some distance. In the subsequent distancing statistically significant increase of characteristics is not observed. It is advisable to use emitters with smaller diameter to reduce losses to the formation of the corona.

The influence on thrust parameter [1-2] and efficiency [3] from geometric parameters and design features [4, 5] of the ionocraft electrode systems (IES) in air at atmospheric pressure and natural humidity [6] is considered. Thrust parameter is represented by magnitude of a generated thrust F [g], and the efficiency is evaluated by magnitude of thrust-to-power ratio, which is equal to ratio of thrust to power consumption F/P [g/W]. Thrust F will increase in proportion to increasing distance of the collector-emitter l if other parameters stay the same [7]. In practice, this dependence cannot be fully performed. Increasing of the zone of acceleration of charged particles leads to an increase of the thrust up to some distance. As l increases, the growth of thrust F is slowing down. Using formula for estimating thrust for ionocraft and expressions for power consumption and I - V curve of corona discharge, thrust-to-power ratio for ionocraft is obtained:

$$\frac{F}{P} = 2l \left(\mu V_k \left(1 + \sqrt{1 + \frac{4I}{CV_k^2}} \right) \right)^{-1}$$

where μ is ion mobility in air; V_k is the critical corona voltage; I is intensity of current; C is a constant value defined for a particular geometry of the system. Hyperbolic dependence for thrust-to-power ratio from current shows necessity of work of ionocraft in modes small values of current I as the most effective. With increasing l , the system with a negative corona becomes more effective in comparison with the device with the positive corona with the similar configuration. The using of emitter with wire diameter $d = 0.02$ mm increase thrust-to-power ratio by 10% compared with wire diameter $d = 0.08$ mm.

REFERENCES

1. B.S. Aleshin et al. *Technical Physics Letters*. **43** (2017) 45.
2. S.L. Chernyshev et al. *Aerosp. Sc. and Tech.* **59** (2016) 155.
3. M.D. Gamirullin et al. *Applied Ph.* **46** (2015) 591.
4. I.E. Rebrov et al. *Tech. Phys.* **61** (2016) 1130.
5. V.Yu. Khomich et al. *JOP: CS.* **652** (2015) 012036.
6. M.D. Gamirullin et al. *TsAGI Science Journal.* **46** (2015) 591.
7. K. Masuyama, S.R.H. Barrett. *Proc. of the Royal Society* **469** (2013) 20120623.