

胡春明,谷俊,周浩.活塞式航空直喷发动机的燃烧特性[J].航空动力学报,2015,30(10):2368-2375

## 活塞式航空直喷发动机的燃烧特性

### Combustion characteristics for direct injection piston aviation engine

投稿时间: 2014-04-09

DOI: 10.13224/j.cnki.jasp.2015.10.010

**中文关键词:** 活塞式航空发动机, 单缸试验机, 燃烧特性, 直喷系统, 最佳喷射时刻

**英文关键词:** piston aviation engine, single cylinder testing engine, combustion characteristics, direct injection system, optimized start of injection

**基金项目:**天津市科技计划项目(13ZCZD GX04400);天津市科技计划项目科技支撑重点项目(12ZCZD GX03800)

**作者**      **单位**

胡春明      天津大学 内燃机研究所, 天津 300072; 天津大学 内燃机燃烧学国家重点实验室, 天津 300072

谷俊        天津大学 内燃机研究所, 天津 300072

周浩        天津大学 内燃机研究所, 天津 300072

**摘要点击次数:** 600

**全文下载次数:** 276

#### 中文摘要:

在ROTAX914化油器式活塞航空发动机的结构基础上,自主开发并研制了一台航空低压空气辅助直喷单缸试验机,开展了不同直喷控制参数包括:喷射时刻、喷射脉宽、喷射压力以及点火提前角对直喷发动机燃烧特性影响规律的研究.研究表明:存在一个最佳喷射开始时刻使得发动机燃烧效率最高,循环变动最低,最佳喷射开始时刻随发动机转速和负荷的增大而相应提前,降低直喷喷射脉宽和喷射压力均会引起发动机最大爆发压力和压力升高率的降低,快速燃烧期延长,燃烧循环变动增加;随着点火提前角提前,最大爆发压力和最大压力升高率增加,燃烧相位提前,循环变动降低.

#### 英文摘要:

Based on the structure characteristics of the ROTAX914 carburetor piston aviation engine, a single-cylinder low pressure air-assisted direct injection aviation testing engine was developed. The influences of different controlling parameters, including injection timing, injection duration, injection pressure, ignition advance angles, on the combustion characteristics of the engine were investigated. The results show that: the engine combustion efficiency gets higher and the combustion cyclic variations get lower at the optimal start injection. With the increase of engine speed and load, the optimal start of injection is advanced accordingly. With the decrease of the direct injection duration and the injection pressure, the peak cylinder pressure and the rate of pressure rise are reduced, the rapid combustion period is extended and the combustion cyclic variations get higher. With the advancing of the ignition time, the peak cylinder pressure and the rate of pressure rise are increased, the combustion phase gets earlier and the combustion cyclic variations are reduced.

[查看全文](#) [查看/发表评论](#) [下载PDF阅读器](#)

关闭

#### 参考文献(共18条):

- [1] 王兴海,马震,郑勇.无人机电小型航空活塞发动机的发展[C]//中国无人大会论文集.北京:中国航空学会,2006:523-527.
- [2] 李玉珍,高丕周,马震.电控汽油喷射改善小型无人机电小型发动机性能的研究[J].航空学报,2004,25(3):233-236. LI Yuzhen, GAO Peizhou, MA Zhen. Research on the improvements of performance of mini-UAV's engine by electronic controlled gasoline injection[J]. Acta Aeronautica et Astronautica Sinica, 2004, 25(3): 233-236. (in Chinese)
- [3] 曾国贵,廖智麟,陶兆成.某型无人直升机活塞式电喷发动机转速控制设计及试验[J].航空动力学报,2011,26(6):1384-1388. ZENG Guogui, LIAO Zhilin, KAN Zhaocheng. Speed control design and test for piston EFI engine of unmanned helicopter[J]. Journal of Aerospace Power, 2011, 26(6): 1384-1388. (in Chinese)
- [4] Döppner M, Foxhall N, Dutzler C, et al. 912iS fuel injected aircraft engine[R]. SAE Paper 2012-32-0049, 2012.
- [5] Baranski J, Anderson E, Grinstead K, et al. Control of fuel octane for knock mitigation on a dual-fuel spark-ignition engine[R]. SAE Paper 2013-01-0320, 2013.
- [6] 王春丰,魏民祥.航空活塞发动机燃烧煤油冷起油量控制研究[J].航空动力学报,2012,27(7):1619-1624. WANG Chunfeng, WEI Minxiang. Research on cold start fuel flow control of aero-piston engine burning kerosene[J]. Journal of Aerospace Power, 2012, 27(7): 1619-1624. (in Chinese)
- [7] 王振宇,丁水汀,杜发荣.航空重油发动机燃油供给系统动力学模型分析[J].航空动力学报,2012,27(4):846-853. WANG Zhenyu, DING Shuiting, DU Farong. Analysis of dynamic modeling of aviation heavy oil piston engine fuel delivery system[J]. Journal of Aerospace Power, 2012, 27(4): 846-853. (in Chinese)
- [8] 胡春明,李骥,洪洪林,等.航空直喷发动机缸内混合气形成的试验[J].航空动力学报,2012,27(9):1921-1927. HU Chunming, LI Jiqi, BAI Honglin, et al. Experiment of in-cylinder mixture formation process low-pressure GDI engine[J]. Journal of Aerospace Power, 2012, 27(9): 1921-1927. (in Chinese)
- [9] Houston R, Cathcart G. Combustion and emissions characteristics of orbital's combustion process applied to multi-cylinder automotive direct injected 4-stroke engines[R]. SAE Paper 980153, 1998.
- [10] Yang J, Munoz R, Anderson R, et al. Study of a stratified-charge DISI engine with an air-forced fuel injection system[R]. SAE Paper 2000-01-2901, 2000.
- [11] Cathcart G, Dikson G, Ahern S. The application of air-assist direct injection for spark-ignited heavy fuel 2-stroke and 4-stroke engines[R]. SAE Paper 2005-32-0065, 2005.
- [12] Cathcart G, Railton D. Improving robustness of spray guided DI combustion systems: the air-assisted approach[R]. SAE Paper 2001-53-60, 2001.
- [13] Cathcart G, Zavier C. Fundamental characteristics of an air-assisted direct injection combustion system as applied to 4-stroke automotive gasoline engines[R]. SAE Paper 2000-01-0256, 2000.
- [14] Jin S, Brear M, Watson H, et al. An experimental study of the spray from an air-assisted direct fuel injector[J]. Journal of Automobile Engineering, 2008, 222(10): 1883-1894.
- [15] Boretii A, Jin S, Zakis G, et al. Experimental and numerical study of an air assisted fuel injector for a DISI engine[R]. SAE Paper 2007-01-1415, 2007.
- [16] LI Yufeng, ZHAO Hua, Brouzos N, et al. Effect of injection timing on mixture and CAI combustion in a GDI engine with an air-assisted injector[R]. SAE Paper 2006-01-0206, 2006.
- [17] Matsubara K, Shima Y, Okumi M, et al. Analysis of mixture formation process in a stoichiometric direct injection gasoline engine[R]. SAE Paper 2003-01-0066, 2003.
- [18] 白洪林,李志军,李骥,等.空气辅助直喷汽油机缸内喷雾特性的试验[J].内燃机学报,2013,31(1):38-44. BAI honglin, LI Zhijun, LI Jiqi, et al. Experiment on spray characteristics with air-assisted injector of direct-injection gasoline engine[J]. Transactions of CSICE, 2013, 31(1): 38-44. (in Chinese)

#### 引证文献(本文共被引1次):

- [1] 刘帅,王忠,赵洋,瞿磊,孙波.点燃式发动机燃烧稳定性的非线性动力学分析[J].农业工程学报,2016,32(14):69-75.

**相似文献(共20条):**

- [1] 李骏,官艳峰,李伟,陈海娥,刘金玉,李金成,李康,姜慧莉.汽油直喷发动机燃烧特性分析[J].西安交通大学学报,2010,44(7).
- [2] 胡建军,黄震,周龙保,黄勇成.缸内直喷式汽油机燃烧特性分析[J].汽车工程,2003,25(6):550-552.
- [3] 李本正,官艳峰,刘圣华,宋睿智,黄勇成,周龙保.甲醇缸内直喷发动机的燃烧特性[J].西安交通大学学报,2008,42(11).
- [4] 李本正,刘圣华,刘杰,李毅.甲醇缸内直喷发动机均质燃烧特性研究[J].农业机械学报,2010,41(4):16-19.
- [5] 何超,葛蕴珊,韩秀坤,陆小明.直喷式柴油机燃用生物柴油的燃烧特性[J].内燃机工程,2007,28(6):7-10,15.
- [6] 刘亮欣,黄佐华,蒋德明,任毅,王金华,王倩.不同喷射时刻下缸内直喷天然气发动机的燃烧特性[J].内燃机学报,2005,23(5):469-474.
- [7] 王金华,黄佐华,刘兵,曾科,余金荣,蒋德明.直喷发动机燃用天然气掺氢混合燃料的燃烧特性[J].西安交通大学学报,2006,40(9):1001-1005.
- [8] 黄勇成,周龙保,刘圣华.缸内直喷灵活燃料发动机燃烧特性的研究[J].西安交通大学学报,2003,37(7):688-691,737.
- [9] 郑建军,王金华,王彬,黄佐华,宁德忠,张英佳.压缩比对直喷天然气发动机燃烧与排放特性的影响[J].内燃机学报,2010(1).
- [10] 白云龙,王志,王建昕.缸内直喷式汽油机废气滞留条件下的燃烧特性[J].内燃机工程,2012(1):1-5.
- [11] 边文超,于兵.缸内直喷航空活塞发动机接口模拟器设计[J].山东交通学院学报,2013,21(2).
- [12] 黄勇成,周龙保,潘克煜.直喷式柴油机燃用E-T柴油时燃烧特性的研究[J].西安交通大学学报,2006,40(1):5-9.
- [13] 祁东辉,刘圣华,官艳峰,周龙保.缸内直喷液化石油气/柴油混合燃料发动机燃烧特性研究[J].西安交通大学学报,2005,39(5):458-462.
- [14] 黄勇成,周龙保,刘圣华.缸内直喷灵活燃料发动机性能和燃烧特性的研究[J].燃烧科学与技术,2003,9(6):501-506.
- [15] 黄勇成,周龙保,刘圣华.缸内直喷醇类燃料发动机的燃烧与排放特性[J].车用发动机,2004(2):19-23.
- [16] 林学东,金文华,李红州.直喷式柴油机燃烧室形状对气流运动及其排放特性的影响[J].汽车技术,2003(12):21-24.
- [17] 尧命发,许斯都,郑尊清,李远洪.直喷式柴油机燃用柴油——LPG双燃料燃烧与排放特性的试验研究[J].汽车技术,2001(1):14-18.
- [18] 黄勇成,李永旺,任杰,周龙保.F-T柴油在直喷式柴油机中燃烧与排放特性的研究[J].燃料化学学报,2005,33(4):492-496.
- [19] 米金泳,钱耀义.直喷式柴油机燃烧室计算机辅助设计[J].内燃机学报,1991,9(1):41-48.
- [20] 袁银南,张恬,梅德清,孙平.直喷式柴油机燃用生物柴油燃烧特性的研究[J].内燃机学报,2007,25(1):43-46.

**友情链接:**[中国航空学会](#)[北京航空航天大学](#)[中国知网](#)[E检索](#)您是第**21165980**位访问者

Copyright© 2011 航空动力学报 京公网安备110108400106号 技术支持:北京勤云科技发展有限公司