

Advances in Research of Coal and Kerogen Nanostructure

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Abstract: The research of structure of coal and kerogen is enhanced by innovation of technology and methodology. From early chemical depolymerization to physical method and then to computer aided molecular modeling, many structural models of coal and kerogen are built up. However, no structural model is widely accepted as the heterogeneity and structural complexity of coal and kerogen enhance the difficulty to illustrate their physical and chemical structure. Nanotechnology greatly promotes the research and knowledge of structure of coal and kerogen. Atomic Force Microscopy (AFM) is a representative example. As result of real-time, real-space, in-situ imaging and ability to partly observe surface structure of single molecular layer, AFM can directly observe the morphology and position of surface defect, surface reconstruction and surface adsorbate and even dynamic process such as surface diffusion. AFM surpasses conventional 2D plane imaging and provides 3D dynamic images and quantitative information. Realizing atomic level resolution and revealing the morphology, size, structure and spatial arrangement of molecular aggregates and nanopores of coal and kerogen, nanotechnology shows great potential in structural research of coal and kerogen. Nanotechnology provides new approaches for basic research of coal and kerogen and supports exploration and exploitation of unconventional oil and gas and research of coal secondary transformation with scientific evidence.

Key words: Coal; Kerogen; Nanostructure; Characterization technology.

欧空局新一代气象卫星

2012年3月欧空局(ESA)与Thales Alenia Space公司签订了第三代气象卫星(Meteosat Third Generation, MTG)开发合同。合同签署后,欧洲气象卫星将于2017年亮相。尽管第三代气象卫星将与现存系列保持充分的连续性,仍然在之前的基础上做了显著改善。

在第二代气象卫星的基础上,MTG是欧洲气象卫星组织(Eumetsat)和ESA的持续合作,这将确保高分辨率气象数据的连续性。

Eumetsat和ESA在气象任务上的合作是一个成功的典范,从1977年制造的第一个气象卫星开始,并一直到今天第二代气象卫星和极轨MetOp系列。

新气象卫星系列将包括6颗卫星:4颗MTG-I图像卫星和2颗MTG-S探空卫星。前2颗图像卫星预定于2017年底至2019年中推出。这2颗卫星将被定位在赤道上空的地球静止同步轨道上,位置在经度 $10^{\circ}\text{E} \sim 10^{\circ}\text{W}$ 之间。除了灵活的成像仪具有先进的成像能力,卫星还将提供全新的红外探测能力和全球闪电成像能力,这将提供强烈风暴的早期预警。MTG-S将搭载4个有效载荷,开展全球环境与安全监测。这种先进的有效载荷将分析大气化学、识别痕量气体(如臭氧和二氧化氮)的浓度。MTG还将对全球搜索和救援监测提供连续支持,同时也支持先进的数据收集系统。

ESA总干事Jean Jacques Dordain强调,新一代气象卫星得益于Eumetsat和ESA间25年的合作,现在欧洲可提供最先进的全球气象监测,今后仍将如此。ESA地球观测计划主任Volker Liebig,预计新卫星在性能上将有显著改善。MTG合同的工业价值超过12.5亿欧元。

合同由ESA的Mr. Liebig和TAS公司的Seznec签订。TAS领导着现在正在建设MTG的工业财团。TAS公司不仅是该项目的主承包商,还负责MTG成像卫星的制造,包括主有效载荷和灵活组合成像仪。布莱梅的OHB公司负责MTG-S卫星,提供总卫星平台,并由Astrium公司提供系统架构。在MTG-S上运行的最先进红外探测仪器将由Kayser Threde开发。

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