

从柏林展会看中国轨道交通的转型

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中国轨道交通踏入新世纪以后,经过5个五年计划的飞速发展,已经形成了16万 km 的铁路网(其中包括4.6万 km 高铁);同时,55个城市开通了超过1万 km 的城市轨道交通线路,这些存量已经超过了国外所有国家高铁里程和地铁里程的总和。进入“十五”计划期间,中国轨道交通的发展速度将明显减缓,由大规模建设与安全运营并重的时期转入以安全、高效、便捷、经济运营为主的稳定发展期。在我国铁路与欧洲发达国家铁路的发展阶段更为接近的当下,2024年9月24日至27日在德国柏林举办的世界轨道交通技术装备展(Innotrans),给我们提供了很好的借鉴。

Innotrans 是世界轨道交通先进技术与装备的一次盛会。这次的展出面积达20万 m²,展览内容涵盖了铁路技术、铁路基础设施、公共交通、隧道建设、车辆内部设计与舒适性五大核心领域。展会以“移动出行的未来”(The Future of Mobility)为主题,聚焦于数字化、智能化解决方案以及电和氢驱动的低碳轨道技术。展会首次设置了移动人工智能(AI Mobility Lab)展区,专门展示人工智能技术在交通领域的应用,讨论AI在交通管理、自动驾驶和乘客服务等领域的前景。

随着大数据时代的到来,如何建立高效的数据采集和传输系统,成为实现数字化转型所面临的重大挑战。西门子的解决方案是通过标准化的应用程序接口(API)访问这些数据,并将其与基于人工智能的分析和评估工具相连接,以提升列车可用性,增强路网承载容量,提高乘客上座率。西门子展示了如何通过信号云基础设施集中信号装备,最大限度地提升路网承载容量,降低维护和运营成本。数字列控系统(ETCS(欧洲列车控制系统)上的全自动列车运行功能相结合,可以极大地提高整个地铁线网的运力。西门子展示的内容代表了欧洲轨道交通在智能化、数字化方面的发展方向。

绿色、低碳出行是展会的另一个主题。中国中车以“On Track for a Low Carbon Future”(为走向低碳的未来铺轨)为主题,展示了在客运和货运交通领域的环保、智能解决方案,同时推出了贯穿整个生命周期的系统解决方案。本次展会首次发布了两款智能环保列车:氢能源智能城际动车组(CINOVA H₂)和智轨快运系统2.0(ART2.0)。CINOVA H₂采用氢燃料电池作为主要动力来源,实现了零排放的环保目标,同时结合了智能化技术,为乘客提供更高效和舒适的出行体验。ART2.0采用橡胶轮胎和虚拟轨道技术,不需要传统的轨道和电线,极大降低了轨道建设和维护成本。此外可以兼容快速充电锂电池、超级电容器、氢能源和架空电缆系统,满足不同运营需求。

阿尔斯通致力于未来交通的三大核心理念:通过全生命周期的减碳解决方案推动可持续性发展;通过数字化赋能提升铁路系统的技术性能与运行效率;提升乘客的出行体验。他们推出的Coradia MaxTM城际单层/双层高效能动力集中电动车组展现了这个理念。该列车适用于高容量的区域运输市场,注重成本效益。其设计灵活,车厢数量可以根据需求调整,以优化运力,并为乘客提供舒适的乘车体验。

欧洲的另一家著名的机车车辆供应商 Stadler(施泰德)展示了八款创新的可持续列车设计,突出替代动力解决方案,如电池和氢能驱动,旨在实现CO₂零排放。

韩国 Hyundai Rotem 公司展示了氢燃料电池有轨电车,该车由韩国多家机构合作开发,续航里程达200 km。

从这些新型车辆可以看出,更加智能、绿色、经济、便捷的轨道交通技术和装备是今后的发展趋势。

吸引客流、降低成本、增加效益将成为中国轨道交通稳定发展期可持续发展的重点:更加注重轨道交通的融合发展,用智能化赋能各个专业提升运输效率,确保运输安全,实现减人增效;以人民为中心,更加关注旅客出行的便捷性;以绿色为信条实现节能减碳。柏林轨道交通展的启示,更加坚定了我国轨道交通技术和装备在建设交通强国路线指引下的发展方向。



Insights on Transformation of China Rail Transit from Berlin Exhibition

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Since entering the new century, China rail transit has undergone rapid development over five consecutive five-year plans, forming a railway network of 160,000 km (with 46,000 km of high-speed railway). Additionally, 55 cities have launched over 10,000 km of urban rail transit lines, surpassing the total high-speed railway and metro mileages of all other countries combined. During the '10th Five-Year Plan' period, the pace of China rail transit development slowed down, transitioning from a phase of large-scale construction and safe operations to a phase of stable development, prioritizing safe, efficient, convenient, and economical operations. At the status quo of China railway development stage aligning more closely with that of developed European countries. The 2024 InnoTrans (International Trade Fair for Transport Technology)—held from September 24 to 27 in Berlin, Germany—provided valuable insights and reference in this context.

InnoTrans is a prominent event for advanced rail transit technology and equipment worldwide. This year's exhibition covered an area of 200,000 m² and featured content spanning five core areas: railway technology, railway infrastructure, public transport, tunnel construction, and vehicle interior design and comfort. With the theme 'The Future of Mobility,' the exhibition emphasized digital and intelligent solutions and low-carbon rail technology powered by electricity and hydrogen. For the first time, the exhibition zone of AI Mobility Lab is introduced, dedicated for presenting AI technology applications in the transportation sector and discussing the prospect of AI in traffic management, autonomous driving, and passenger services.

The advent of the big data era poses significant challenges in establishing efficient data collection and transmission systems, essential for achieving digital transformation. Siemens' solution involves accessing this data through standardized application programming interfaces (API) and linking it with AI-based analysis and evaluation tools to enhance train availability, boost network capacity, and increase passenger occupancy rates. Siemens demonstrated how signal cloud infrastructure can be used to centralize signaling equipment, thereby maximizing network capacity, and reducing maintenance and operational costs. By integrating the digital train control system with the fully automated train operation functions of the ETCS (European Train Control System), the entire metro network's capacity can be significantly increased. The innovations presented by Siemens represent the direction of Europe rail transit development towards intelligence and digitization.

Green, low-carbon travel was another key theme of the exhibition. Under the theme 'On Track for a Low Carbon Future', CRRC Co., Ltd displayed environmentally friendly, intelligent solutions in passenger and freight transportation, alongside comprehensive lifecycle system solutions. The company debuted two intelligent and eco-friendly trains: the hydrogen-powered intelligent intercity EMU (CINOVA H₂) and the Autonomous Rail Rapid Transit 2.0 (ART2.0). The CINOVA H₂ utilizes hydrogen fuel cells as its primary power source, achieving a zero-emission environmental goal while incorporating intelligent technologies for a more efficient and comfortable passenger experience. The ART2.0, employing rubber tires and virtual track technology, eliminates the need for conventional tracks and overhead wires, significantly reducing track construction and maintenance costs. Additionally, it is compatible with fast-charging lithium batteries, supercapacitors, hydrogen energy, and overhead cable systems, catering to diverse operational needs.

Alstom is committed to three core principles for the future of transportation: promoting sustainable development through carbon reduction solutions across the entire lifecycle, enhancing the technical performance and operational efficiency of railway systems through digital empowerment, and improving passenger travel experiences. Their Coradia MaxTM intercity single/double-deck high-efficiency power centralized EMU embodies these principles. Designed for high-capacity regional transport markets, this train emphasizes cost-effectiveness. Its flexible design allows for adjustable compartment configurations to optimize capacity while providing passengers with a comfortable travel experience.

Stadler, another renowned European locomotive and rolling stock supplier, showcased eight innovative and sustainable train designs, highlighting alternative power solutions such as battery and hydrogen drives for achieving zero CO₂ emissions.

Hyundai Rotem from South Korea presented its hydrogen fuel cell tram, developed in collaboration with various Korean institutions, boasting a range of 200 km.

These innovative vehicles signal the future trends in rail transit technology and equipment to be the smarter, greener, more economical, and more convenient solutions.

Attracting passenger traffic, reducing costs, and increasing efficiency will be key focuses for the sustainable development of China rail transit during its stabilization period. This includes a greater emphasis on integrated rail transit development, leveraging intelligent technology to enhance operational efficiency and ensure transport safety, achieving labor efficiency improvements, and a people-centered approach to enhance travel convenience. Adopting green practices as a guiding principle will further energy conservation and carbon reduction. The insights from the Berlin rail transit exhibition reinforce the direction of China rail transit technology and equipment development under the guidance of building a strong transportation power.

Translated by ZHANG Liman