

## 汽车薄钢板应力应变曲线及屈服轨迹的研究

吴向东, 万敏, 周贤宾

北京航空航天大学机械工程及自动化学院, 100083

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**摘要** 采用十字形双向拉伸的实验方法对两种汽车用薄钢板BH220和SPEN进行了不同加载路径下的双向拉伸试验, 得到了不同应力状态下的应力应变关系曲线, 同时, 根据单位体积塑性功相等的原则, 确定了两种钢板等效塑性应变从0.2%~2%的实验屈服轨迹. 结果分析表明: 不同加载路径下板料的应力应变关系不同, 随着加载比例由单拉到等双拉状态, 板料的硬化指数逐步增大; 实验屈服轨迹呈外凸性, 且以等双拉为界的上下部分屈服轨迹不对称, 随着变形程度的增加, 屈服轨迹向外扩大, 但单拉时强化程度最小, 而等双拉时最大. 对BH220和SPEN钢板的实验屈服轨迹与几种常用理论屈服轨迹的比较发现, Hosford各向异性屈服准则的理论轨迹与实验结果最为接近, Hill48准则与实验结果相差最大, 此外一向被视为只适用于各向同性材料的Mises准则与实验结果也较为接近, 其他几个屈服准则的理论屈服轨迹与实验点相差较大.

**关键词** [双向拉伸试验](#), [十字形试件](#), [应力应变曲线](#), [屈服轨迹](#), [各向异性板料](#)

分类号

## Stress-strain curves and yield loci of auto steel sheet

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北京航空航天大学机械工程及自动化学院, 100083

### Abstract

On the basis of biaxial tensile experimental system, two types of steel sheet were studied under different loading paths using optimized cruciform specimens with slots in the arms. According to the experimental true stress-logarithmic strain curves, the stress-strain curves of steel sheet vary with the stress state, and the strain-hardening exponent become larger when the load ratio is near the ratio 1:1. The contours of experimental yield loci for two steel sheets from 0.2% to 2% plastic strain were determined based on the equivalent plastic work principle. It is found that the shape of yield loci does not show symmetry along equibiaxial stretching path because of anisotropic mechanical properties. The geometry of the experimental yield loci were compared with the yield loci calculated from several existing yield criteria and the analytical result shows that the Hosford yield criterion describes the general trends of experimental yield loci of steel sheets very well, whereas the Hill48 yield criterion overestimated the yield stress in all the contours. In addition, the Mises yield criterion that is generally used in isotropic materials also gives good fitness to the experimental yield loci.

**Key words** [biaxial tensile test](#) [cruciform specimen](#) [stress-strain curves](#) [yield locus](#) [anisotropic sheet metal](#)

DOI:

通讯作者 [xdwu@buaa.edu.cn](mailto:xdwu@buaa.edu.cn)

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