A Study on DLC Tool Coating for Deep Drawing and Ironing of Stainless Steel

The trend in metal forming tribology is to develop new tribo-systems including new lubricants, tool materials and tool coatings in order to substitute environmentally hazardous lubricants by environmentally friendly tribo-systems. In preliminary testing the limits of lubrication of new tribo-systems for sheet forming production, it is advantageous to use dedicated simulative tribo-tests. This paper studies the influence of tool coatings on deep drawing operations using the Bending Under Tension (BUT) test and also under more severe tribological conditions by adopting the Strip Reduction Test (SRT) to replicate industrial ironing of deep drawn, stainless steel parts. Non-hazardous tribo-systems in form of a double layer Diamond-like coated tool applied under dry condition or with an environmentally friendly lubricant were investigated via emulating industrial process conditions in laboratory tests. Experiments revealed that the double layer coating worked successfully, i.e. with no sign of galling, when it was used with environmentally friendly lubricants, whereas the results were more prone to galling under dry condition.