IMPROVED COATING PUNCHES①

※Quality improvements in place since April 2006

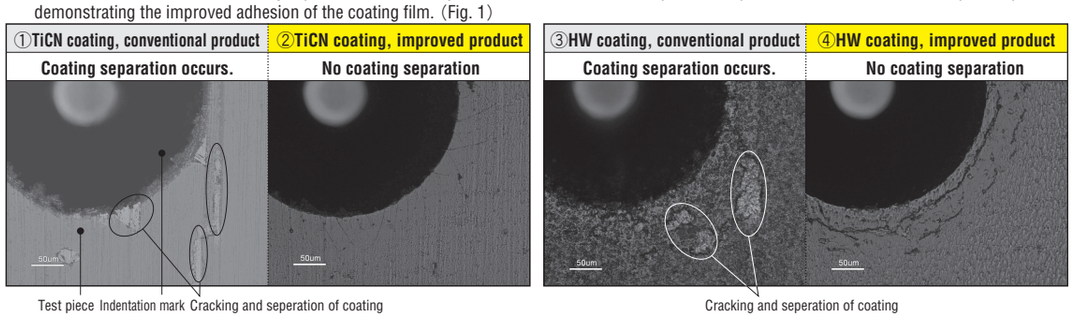
■Introduction

In recent years, there has been growing use of high-tensile steel sheet in the automobile industry due to increasing worldwide demands for weight reduction and higher safety performance.
The punching conditions for high-tensile steel sheet become increasingly severe year after year, leading to problems of early wear and chipping. Consequently, there is much interest in increasing the life spans of the punches.
So-called “coating punches” with improved coating adherence and wear resistance have been commercialized in order to solve these problems. These improved coating punches have much longer life spans than conventional products.

■Features of improved coating punches

■Better adhesion of the coating film

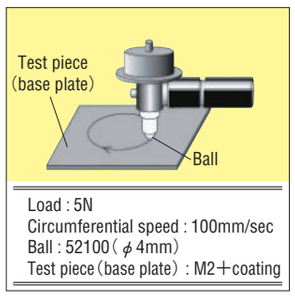
Unless the coating film adheres strongly to the base material, the film will quickly separate due to external stress despite its excellent coating properties. Accordingly, in order to evaluate the adhesion force of the film, indentation tests using a Rockwell hardness tester (C scale) were performed, and the conditions of film separation were observed.
The tests showed that while coating separation and cracking occurred in the conventional product, separation did not occur in the improved product, demonstrating the improved adhesion of the coating film. (Fig. 1)



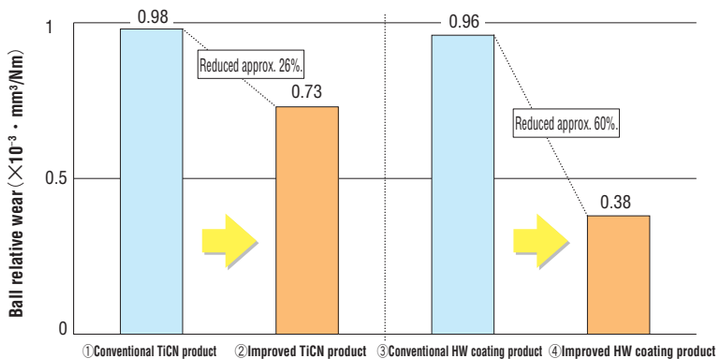
(Fig. 1) Results of observation after indentation test (test piece material: SKH51)

■Improved wear resistance

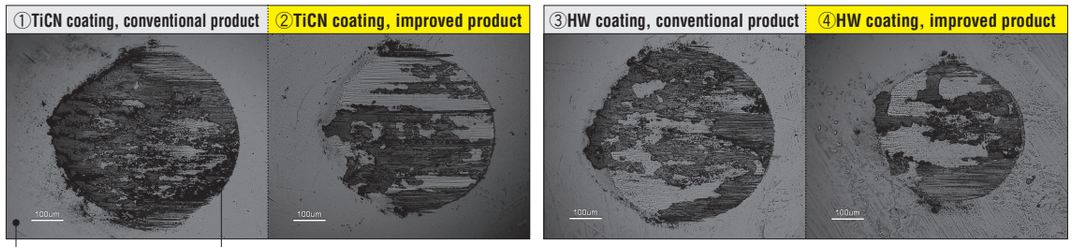
One cause of punch wear is adhesive wear in which the workpiece and punch stick together, causing wear of both parts.
In order to evaluate the wear resistance, a friction wear test was carried out and the relative wear of the ball was measured.
Here, the test piece (base plate) simulates the punch and the ball simulates the workpiece (Fig. 2), and the relative wear of the ball was measured in order to determine the superiority or inferiority of the wear resistance.
Compared to the conventional product, ball relative wear fell by approximately 26% when a TiCN coating was used, and by approximately 60% when an HW coating was used. (Fig. 3)
This test also shows that the improved product ball has a smaller friction surface (Fig. 4) and better wear resistance than the conventional product.



(Fig. 2) Overview of friction wear test



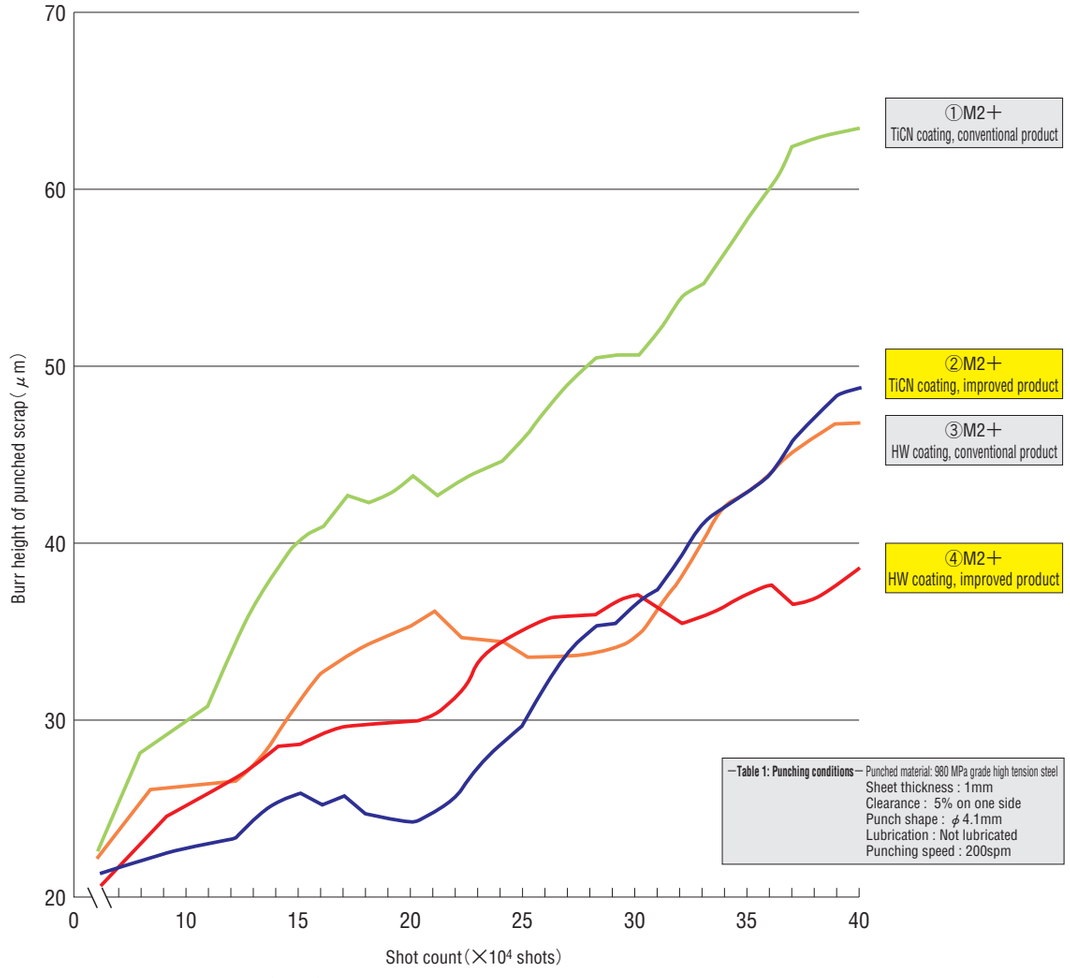
(Fig. 3) Relative wear of ball after friction wear test



(Fig. 4) Ball friction surface after friction wear test

■Punching life span test with 980 MPa high-tensile steel

A punching life span test using 980 MPa high-tensile steel was carried out, and the burr height of the punching scrap was measured (Fig. 5).
(Test conditions: Table 1)
If the maximum allowable burr height is assumed to be 50 μm, the improved TiCN coating product can be used for a minimum of 1.5 times the number of shots as the conventional product.
A comparison of the burr height after 400,000 shots shows that the improved HW coating product produces scrap with the smallest burr height, and also that this punch has the highest durability of the coating punches used in this punching test.



(Fig. 5) Changes in burr height with increasing shot count