Sosform®

DIECUTTING

Solutions

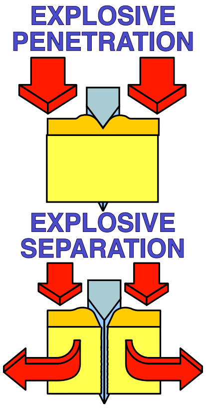
SANDVIK

Issue No. 4

Dieflex Brite

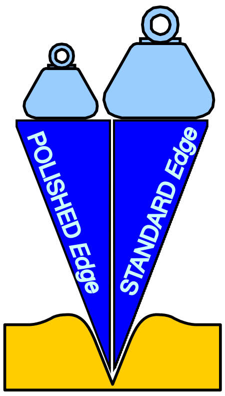
A Penetrating Opportunity

The resistance of a material to the penetration of a cutting knife, with specific parameters, is defined as ***"pressure"*** in platen diecutting. Unfortunately, the challenge we face in achieving a kiss-cut press make-ready, is the higher the pressure applied to diecut the material, the lower is our ability to manage the cutting impression and to control diecut part quality.



Platen diecutting is accurately described as a combination of two forces. ***Explosive Penetration & Explosive Separation***. This simply means we ***"burst"*** through the surface of the material, and then use the bevel faces of the blade to drive the material apart, until it ***"ruptures"*** under the lateral stress. ***See above***.

The disadvantage of this, is in many paperboard materials, and particularly recycled material, the higher levels of explosive force, generate excess dust and loose fiber. To provide a solution to this problem, Sandvik introduced ***Dieflex Brite***. This extraordinarily successful material has enviable bending parameters for diemaking, and the engineered profile of the ***Dieflex*** base has made this blade the most successful cutting knife in the industry.

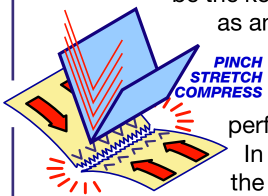


However, what has made ***Brite*** so innovative is the bevel faces are highly polished, or re-ground in an additional process, with the result the surfaces are exceptionally smooth. These polished bevel surfaces reduce penetration pressure, they reduce the degree of explosive force, and they significantly lower incidents of dust and loose fiber. ***See above***.

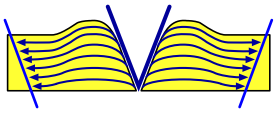
Dieflex Brite, another steel rule diecutting innovation from Sandvik.

The Importance of the Knife Bevel Angle in Diemaking & Diecutting

Diemaking and Diecutting are primarily focused upon Pressure Management and Pressure Control. We often talk about; ***"adding pressure,"*** and/or ***"patching-up,"*** which is another way of adding pressure in diecutting. Although pressure management should be the key focus of steel rule die design and layout, it is rarely considered as an important factor, prior to on-press make-ready.

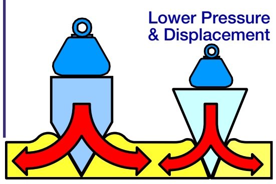


In diecutting the most important tool is the steel rule cutting knife, and the related steel rules, such as creasing, scoring and perforating rules, as they are the source of the converting action. In addition, although the entire body of the knife is important, the cutting edge, and particularly the amount of cutting edge, which is penetrating the material, is most critical.

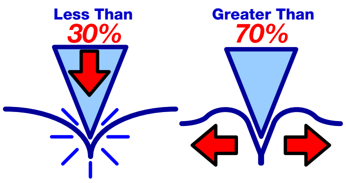


Where does Diecutting Pressure Originate?

In principle platen diecutting is a ***Displacement Process***, and the cutting or separation of materials is achieved through a displacement action and not the cutting action it appears to be. As the knife/wedge is driven into the material, it simultaneously compresses and stretches the material surface, until the surface ***"ruptures"*** under the combination of stretching and compression stresses. ***See above left***. At this point the bevel angles of the knife take over the diecutting action, and the action of the cutting edge of the blade is less important. As the platen mechanism continues to close, the knife bevels drive the material laterally away from the center point of the knife and the center of effort, which is the cutting edge of the knife. ***See above right***.



The total splitting force generated in diecutting is a function of the bevel angle of the blade. The greater the bevel angle the greater the displacement force, and the lower the bevel angle the lower the displacement force. ***See above left***. Although it varies from blade design to blade design, the force used in diecutting a material, is approximately 30% knife-edge action, and 70% knife bevel action. ***See above right.*** Therefore, although the selection of the correct cutting edge profile is critical, it is the bevel angle of the knife, which has the greatest impact on diecutting.

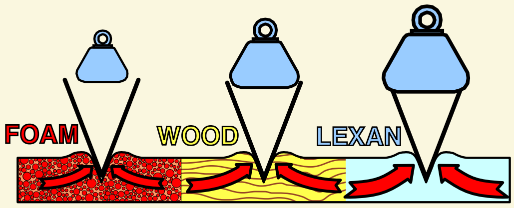


Therefore, it is important to recognize that pressure is primarily derived from the bevel angle of the cutting knife, but is the use of the term ***"Pressure"*** correct in diecutting?

Diecutting Pressure Management

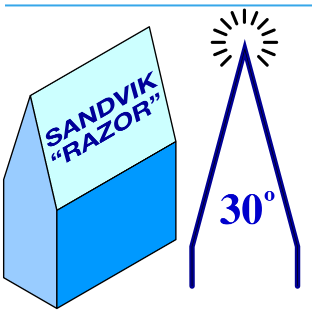
Although we use the term ***"pressure"*** in diecutting, it is more accurate to describe ***"pressure"*** as a measurement of the compressive resistance of a specific material to the penetration of a knife with a specific edge profile and a specific bevel angle. For example, if we were diecutting three materials with identical calipers or thicknesses. These could be Soft Foam, Wood or Aluminum, with a thickness of say 0.010" or 0.254 millimeters. The travel distance of the lower or the upper platen in cutting these materials is identical but the ***"pressure to diecut"*** or the resistance of the material to penetration is very different. ***See left***.

As the density of material increases the resistance or "Pressure" to diecut increases.

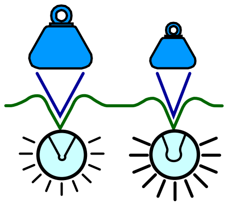


However, the "Travel Distance" or the distance the blade travels to cut through each material is identical!

Clearly a 52-degree bevel knife would be perfect for the thin foam, but to cut the denser wood or aluminum, it would be an advantage to minimize the high levels of compressive resistance by using the powerful penetrating force... *Continued on Page 2*

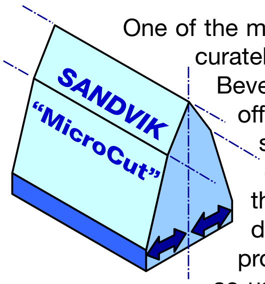


of ***Sandvik Razor. See left***. However, this should not suggest, that the most effective bevel angle for every material is 30 degrees! For example, which of the knife bevel angles shown ***below right,*** would be more susceptible to compressive edge damage? Obviously, the lowest bevel angle, therefore, it is important to match the correct knife to the correct application, to the correct diecutting technology. This will often mean choosing between a Hard or a Soft Anvil, based upon the material characteristics.

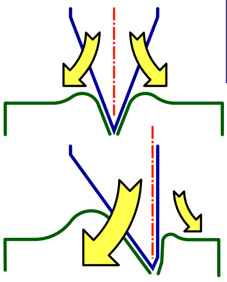


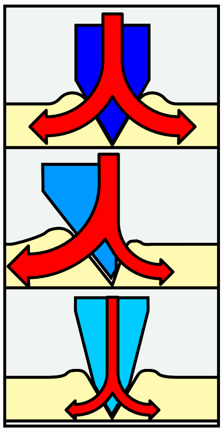
Which is why the combination of bevel angles and edge finishes in the revolutionary ***Sandvik MicroCut Multi-Bevel*** knife profile is such an important development in diecutting. ***See below left***. If you are not using this extraordinary knife, you should really consider it, as it is destined to become a standard throughout the industry.

Integrating Different Knife Bevel Angles?



One of the most obvious examples of pressure management, or more accurately, displacement management in diecutting is the use of Side Bevel Knife. In this knife the cutting edge is offset from the center of the blade, with a small support bevel on one side of the cutting edge and a large bevel face on the other side. However, it is the lateral displacement action of the blade, which provides the cutting characteristics we find so useful. You will note in the ***illustration to the right***, that the displacement action of the bevel surfaces generates a large pressure ridge on one side of the knife, with a minor pressure ridge on the other. In a low-density material this pressure ridge is temporary and the memory of the material causes it to dissipate almost as soon as the blade is withdrawn from the material. However, when diecutting a dense and a tough, hard material, the pressure ridge may become a permanent feature of the diecut part.



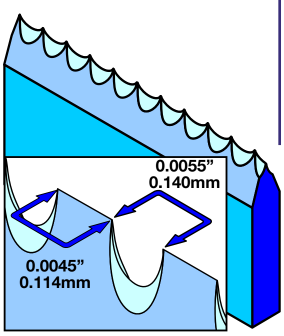


Therefore, the side bevel knife enables the distortion to be pushed into the waste areas of the diecut material and away from the product areas, simply by the correct orientation of the blade. However, it is the displacement action, the resulting degree of material distortion, and the overall increase in cutting pressure, which are critical. The selection of the correct cutting edge and profile, and the choice of the most effective knife bevel angle, in single or a multiple cutting and displacement surfaces, is a critical issue in all forms of diecutting. What is extraordinary in the ***illustration to the left,*** is the comparison in pressure control management of the MicroCut Blade, which provides greater control by minimizing lateral displacement. It is this multi-faceted approach to diecutting, which is making ***Sandvik MicroCut*** such an industry wide success.

Pressure Management Summary

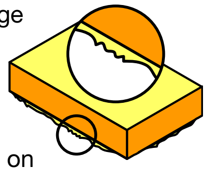
Pressure Management in diecutting has always been a compromise between the bevel angle of the blade, and the ability to sustain the sharp, extended cutting performance of the knife edge. While single bevel and side bevel knife will always have a major role to play, the introduction of ***MicroCut***, both as a cutting knife, and as a platform for edge innovation, is changing the face of diecutting quality and performance.

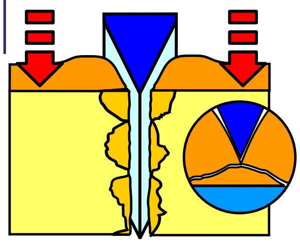
One of the innovations, using the ***MicroCut*** foundation, is ***Plasti-Crease***, ***see right***, designed and proven to enable simple, bullet proof creasing and folding of plastic transparent materials.



What is Flaking?

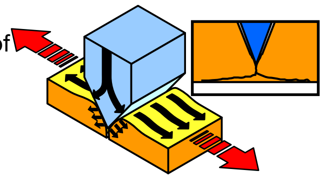
Flaking or Chipping is a failure of the ***“underside”*** of the edge of a diecut part, which results in a ragged, torn profile, ***see right***, and/or a series of fractured, jagged tears on the bottom surface of the diecut material, adjacent to the cutting edge. ***See left***. The challenge with Flaking is the torn flakes on the liner or on the bottom outer layer of the material are still attached to the body of the material by secondary fiber, and are therefore impossible to remove or to disguise. They are in fact a permanent feature of the finished product, and inevitably they lead to a product rejection.





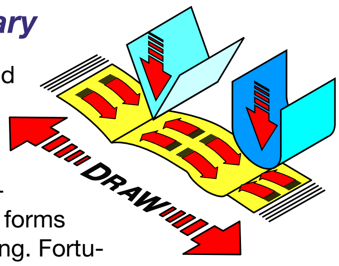
What Causes Flaking?

There are two primary forces, which when combined generate excessive lateral force, which causes the material to prematurely delaminate. The first of these is the displacement action of the cutting knife, ***see below***, which converts vertical force into a lateral action, driving the material at right angles to the center of effort of the blade.



The second force causing flaking is Diecutting ***“Draw.”*** The term draw describes the lateral ***“Tensile Stress”*** generated in a sheet of material by the converting action of the steel rule die. ***See right***.

Summary



Flaking and edge chipping are common problems in all forms of diecutting. Fortunately the source of the problem is straightforward, and the various techniques and methods to eliminate the problem, are simple and effective. Articles in future editions of the publication will provide guidelines to eliminate the Flaking problem, permanently!