

## The damage part of VUMAT

```
y1=sqrt(sigtri(1)**2+sigtri(2)**2+sigtri(3)**2+2.D0*sigtri(4)**2+
```

```
1 2.D0*sigtri(5)**2+2.D0*sigtri(6)**2)
```

```
y2=(sigtri(1)*strainInc(k,1)+
```

```
1 sigtri(2)*strainInc(k,2)+
```

```
1 sigtri(3)*strainInc(k,3)+
```

```
1 sigtri(4)*strainInc(k,4)+
```

```
1 sigtri(5)*strainInc(k,5)+
```

```
1 sigtri(6)*strainInc(k,6))/y1
```

```
Yz=akisi*Yz
```

```
Yf=akisi*Yf
```

```
stateNew(k,1)=sig(1)
```

```
stateNew(k,2)=sig(2)
```

```
stateNew(k,3)=sig(3)
```

```
stateNew(k,4)=sig(4)
```

```
stateNew(k,5)=sig(5)
```

```
stateNew(k,6)=sig(6)
```

```
eps_eqz = sqrt(2.d0*Yz/xE0)
```

```
eps_eqf = Yf/xE0/(1.d0-alpha)
```

```
xz = eps_eqz/eps cz
```

```
xf = eps_eqf/eps cf
```

```
roz = fc z/xE0/eps cz
```

```
rof = fc f/xE0/eps cf
```

```
xnz = 1.d0/(1.d0-roz)
```

```
xnf = 1.d0/(1.d0-rof)
```

```
stateNew(k,18) = xf
```

```
stateNew(k,19) = eps_eqf
```

```
if(Yz.gt.sv yz)then
```

```
if(xz.le.one)then
```

```
stateNew(k,9) = one-
```

```
1 roz*xnz/(xnz-one+xz**xnz)
```

```
else
```

```
stateNew(k,9) = one-
```

```

1      roz/(alphaz*(xz-one)**two+xz)
endif
else
stateNew(k,9) = svdnz
endif

if(yf.gt.svyf)then
  if(xf.le.one)then
stateNew(k,10) = one-
1      rof*xnf/(xnf-one+xf**xnf)
else
stateNew(k,10) = one-
1      rof/(alphaf*(xf-one)**two+xf)
endif
else
stateNew(k,10) = svdnf
endif

do i=1,6
stressNew(k,i)=(1.D0-stateNew(k,9))*sigz(i)+
1 (1.D0-stateNew(k,10))*sigf(i)
enddo

fail = 0.95d0

if(stateNew(k,9).ge.fail.or.stateNew(k,10).ge.fail)then
stateNew(k,11) = zero
else
stateNew(k,11) = one
endif

```