4.2 ROTATING DISKS

The rotating disk facilities show very high differentiation of the damage rate. Cavitation intensity in IMP, KSB and SIGMA labs was sufficient to test the tarnamide specimens which showed however lower volume loss than the highly resistant 1H18N9T steel (Table 13, Fig.19, 20). The shape of erosion curve determined in the IMP lab reveals that an abrupt increase of erosion rate followed the initial period in which cracks and plastic deformations developed.

The ordering of damage rates follows the ordering of materials appearance in Table 1 except for the M63 brass showing in the CSSRC better resistance than the 45 carbon steel which performed relatively poor in this lab. High relative resistance of the M63 brass might be due to the work hardening effect of M63 subjected to cavitation of very low intensity. Erosion rate of M63 brass, E04 Armco iron and 1H18N9T stainless steel at the CSSRC rig was so small that the erosion curves obtained in this lab lie practically on the time axis in Figs 21 and 22.

By comparing erosion rates of 5 materials shown in Figs 21 and.22, it can be stated that rotating disks with cavitators in form of cylindrical bolts and specimens inlaid in the disk surface (IMP) show much higher erosion rate than those with cavitation wakes generated by holes in the disk (CSSRC, SIGMA).

The volume loss rate and *MDPR* values at the rotating specimen rigs (IMP) are also higher than those with stationary specimens (KSB). The obvious advantage of using stationary samples is the possibility of direct measurement of cavitation impingement by means of pressure transducers as it is the case in all cavitation tunnels

In order to compare the KSB and SIGMA rigs one cannot use the *MDP* vs time curves as the "eroded area" in Table 13d represents the total exposed surface area. From Fig.21 it can be seen that volume loss rate in SIGMA VU was smaller than in KSB for all the ferrous metals. The difference was the highest for 45 carbon steel which can be attributed to the very high hardness of this material. In case of the M63 brass erosion rates were almost the same and in case of the PA2 alloy erosion rate in SIGMA lab was higher than that in KSB. In this case also the incubation period of the PA2 specimen erosion is smaller in SIGMA lab than at KSB. One might suppose that this effect results of much higher amount of small amplitude cavitation pulses in Olomouc than in Frankenthal.

Table 13a Test Series Summarisation Table of the CSSRC rotating disk facility (cavitator: hole, specimen: rotating, pressure[1]: 103 kPa, peripheral velocity: 43 m/s)

Material	*test duration*	*Volume loss*	*eroded area*	*incubation period*	$MDPR_{max}$
	min	mm^3	mm^2	min	μm/min
PA2	160	24.00	750	89	0.480
M63	200	0.68	391	3	0.022
45	360	2.41	464	70	0.022

[1] absolute value

Table 13b Test Series Summarisation Table of the IMP rotating disk facility (cavitator: bolt, specimen: rotating, pressure[1]: 255 kPa, peripheral velocity: 43 m/s)

Material	*test duration*	*volume loss*	*eroded area*	*incubation period*	*$MDPR_{max}$*
	min	mm^3	mm^2	min	µm/min
PA2	1200	1319.8	661.2	10	18.20
M63	1200	763.46	517.6	30	3.10
E04	1200	386.28	643.8	40	0.77
45	1200	200.26	625.8	>450	>0.43
1H18N9T	1200	188.91	432.0	>585	>0.44
Tarnamide	1200	108.85	197.9	750	1.47

Table 13c Test Series Summarisation Table of the KSB rotating disk facility (cavitator: bolt, specimen: stationary, pressure[1]: 46.4 kPa, peripheral velocity: 29.6 m/s)

Material	*test duration*	*volume loss*	*eroded area*	*incubation period*	*$MDPR_{max}$*
	min	mm^3	mm^2	min	µm/min
PA2	120	31.8	203.7	30	1.85
M63	480	8.85	130.1	>180	>0.225
E04	960	22.0	167.8	>325	>0.194
45	1200	23.4	187.4	>510	>0.185
1H18N9T	1740	13.3	105.3	>580	>0.116
Tarnamide	6000	24.4	88.7	500	0.056

Table 13d Test Series Summarisation Table of the SIGMA rotating disk facility (cavitator: hole, specimen: rotating, pressure[1]: 101.4 kPa, peripheral velocity: 60.2 m/s)

Material	*test duration*	*volume loss*	*Eroded area*	*incubation period*	*$MDPR_{max}$*
	min	mm^3	mm^2	min	µm/min
PA2	300	77.3	982	22.5	0.405
M63	2400	53.1	982	350	0.039
E04	2400	34.1	982	550	0.018
45	3000	34.9	982	>1875	>0.036
1H18N9T	3000	16.9	982	>1138	>0.009
tarnamide	3000	2.9	982	75	0.033

[1] absolute value

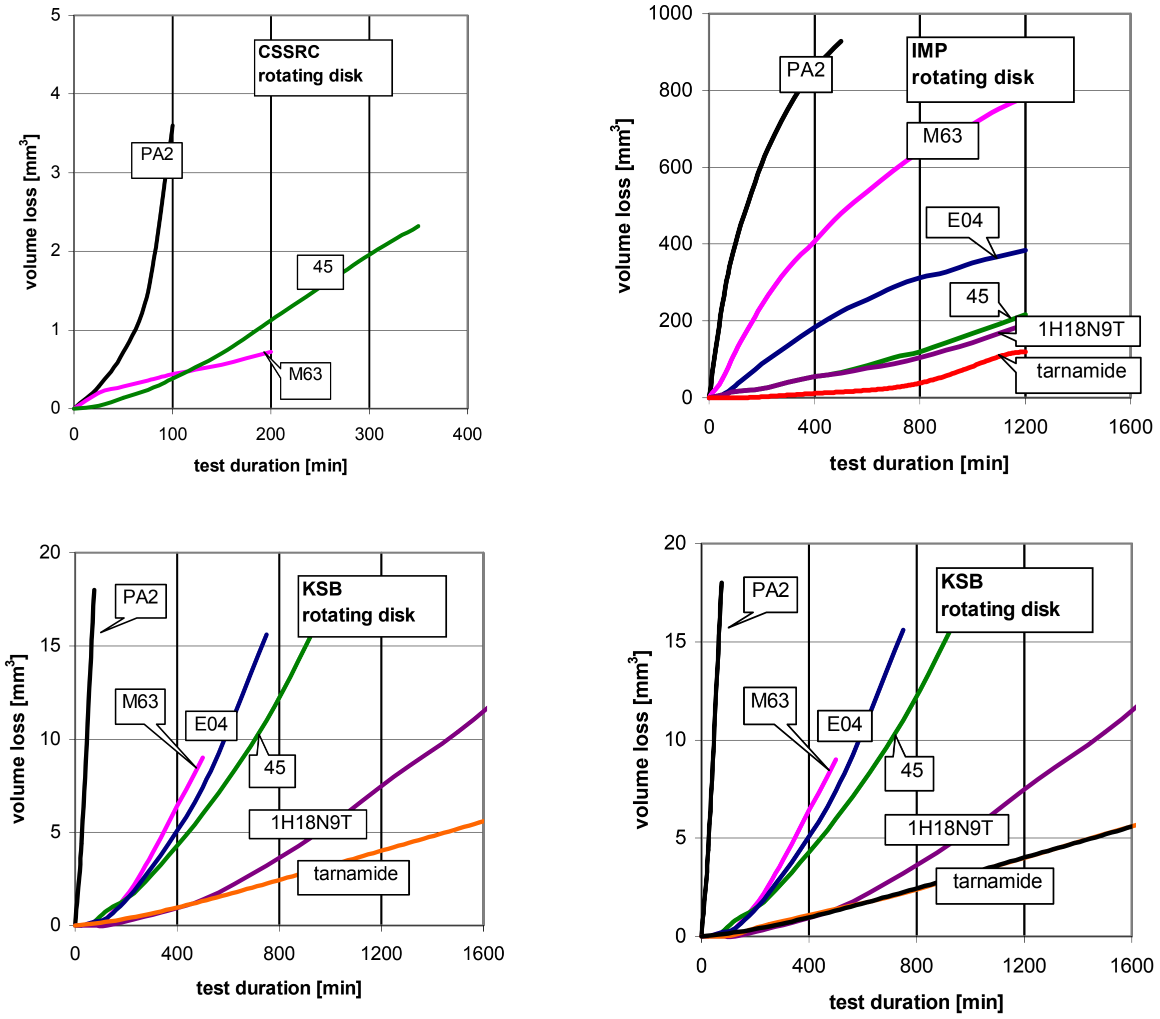

Fig.19 Cumulative volume loss curves of the ICET materials tested at 4 rotating disk facilities

Essential factors to be taken into account when comparing rigs of similar design are the peripheral velocity of the cavitator and the pressure in the test chamber. By comparing the test parameters in CSSRC with those in SIGMA Research Institute one can notice that lower peripheral velocity was applied in Wuxi while pressures were kept at almost the same level as in Olomouc.

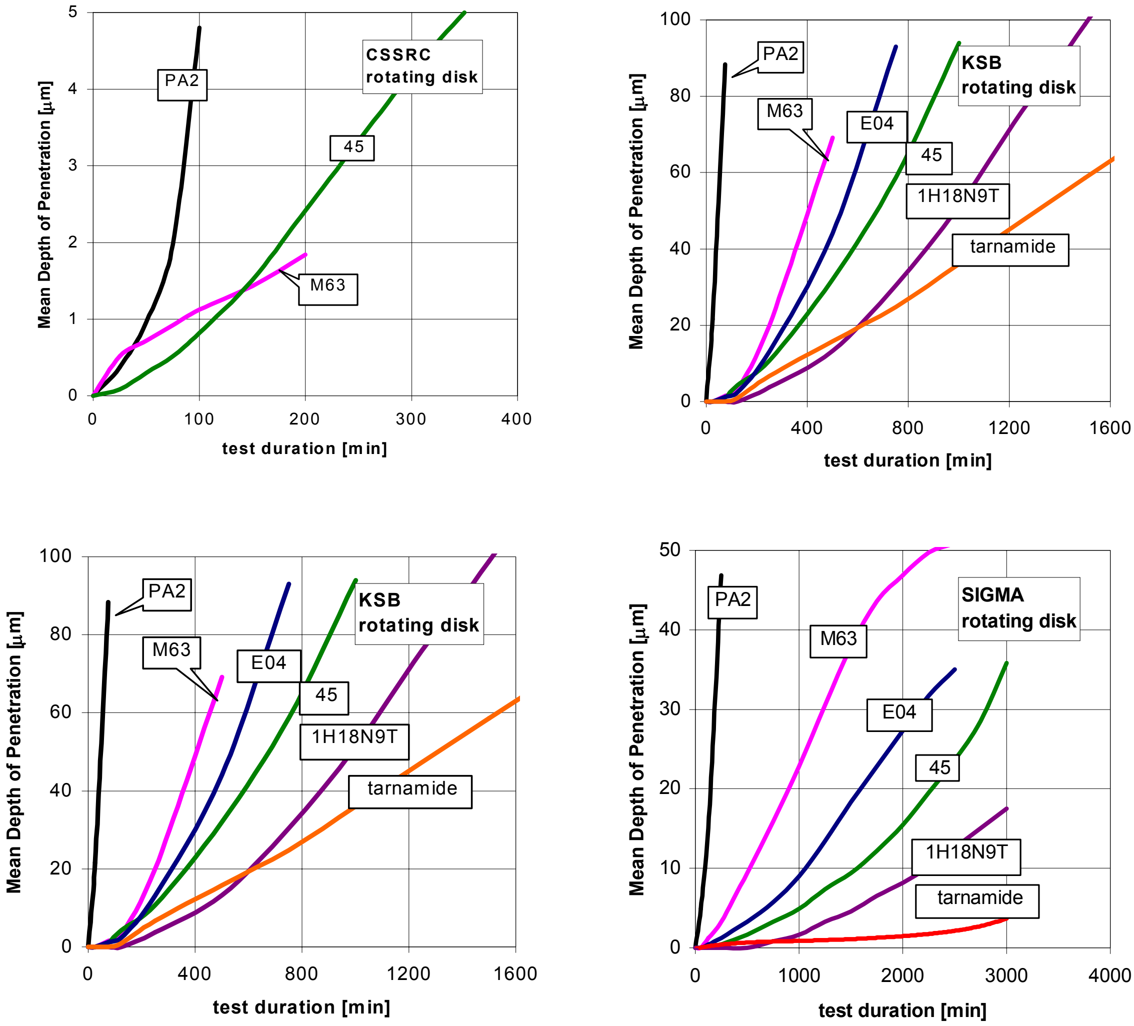

Fig.20 Mean depth of erosion penetration curves of the ICET materials tested at 4 rotating disk facilities

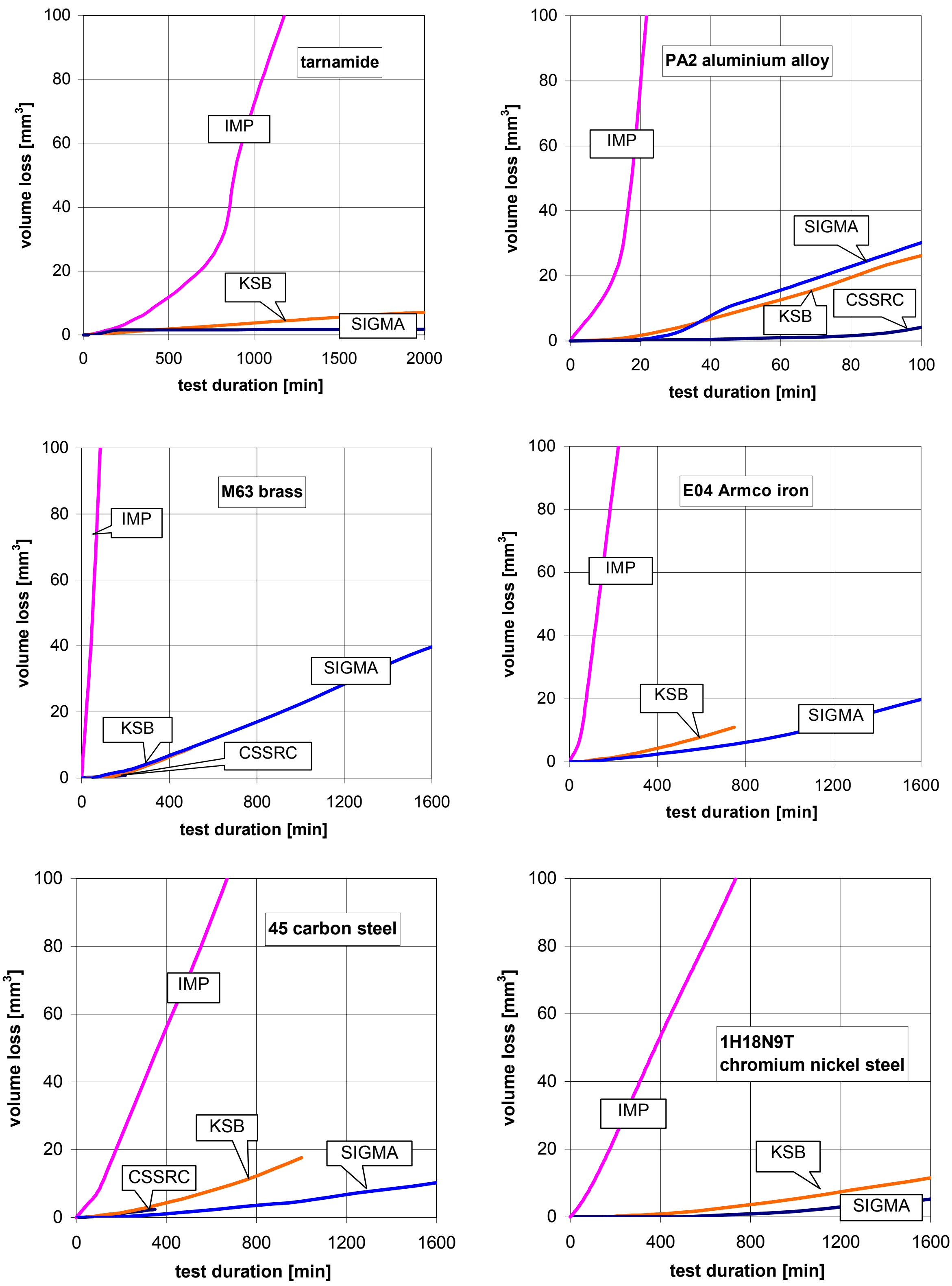

Fig.21 Cumulative volume loss curves of the ICET materials tested at 4 rotating disk facilities

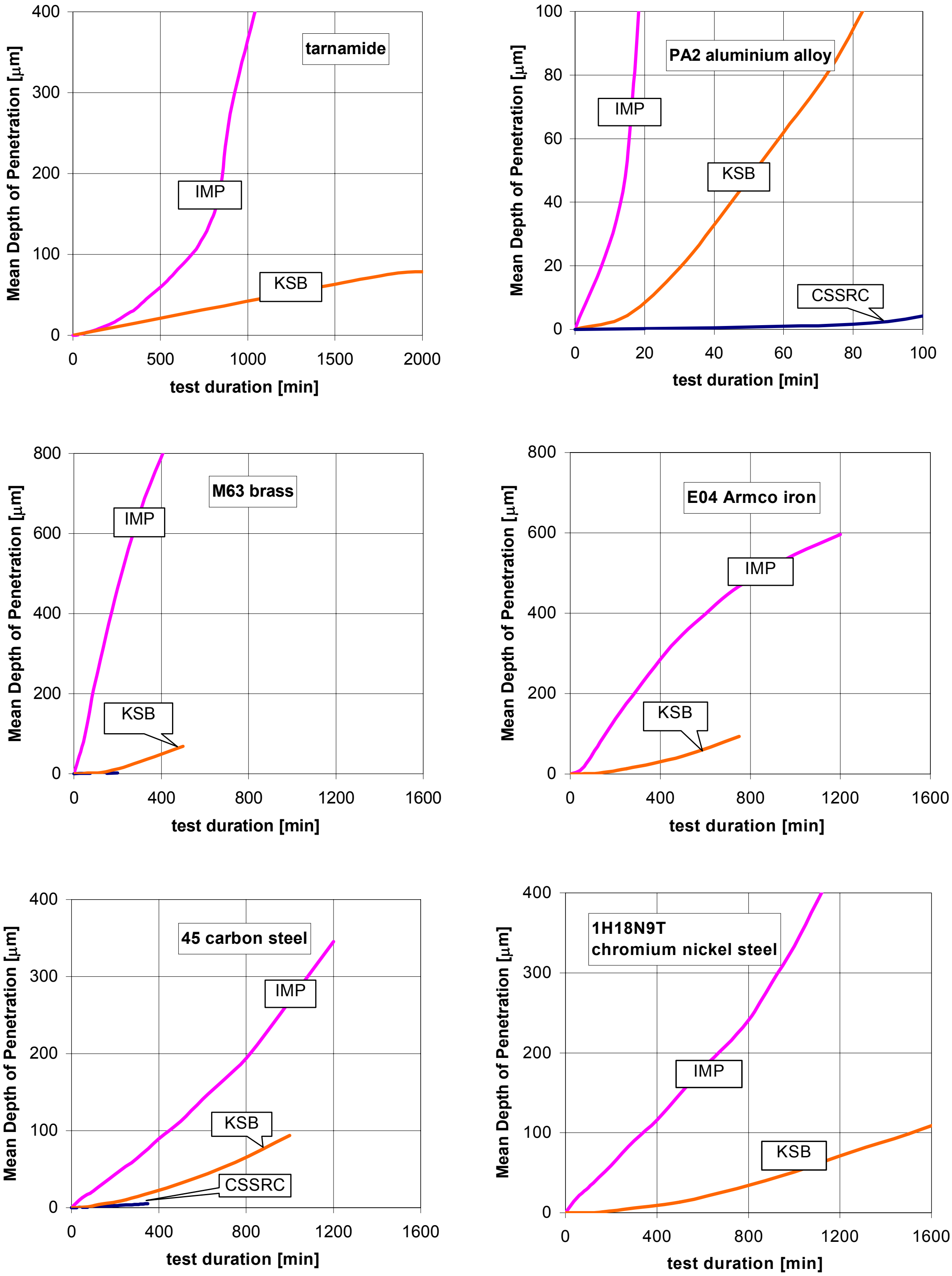

Fig.22 Mean depth of erosion penetration curves of the ICET materials tested at 3 rotating disk facilities